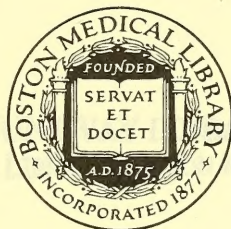



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CHAPTER VI.

SURGERY OF THE ESOPHAGUS.

Esophagitis.—This disease, if we except those cases arising from injuries, is of rare occurrence; yet it is of sufficient frequency to demand the attention of the surgeon. The causes are various. It may be produced by an extension of an inflammation of the pharynx or stomach, or it may result from the excessive use of alcohol, or the incautious or prolonged use of ice or ice-cold drinks. The specific diseases, as tuberculosis, syphilis and diphtheria, are responsible for some cases. In the beginning the disease presents the characteristic condition of an acute catarrhal inflammation of any mucous membrane. The mucous membrane becomes congested and red, with more or less infiltration of the sub-mucous tissue, the muciparous glands enlarge and the secretions increase. If a high degree of inflammation exists, greatly impairing the capillary integrity, ulceration, abscess or possibly gangrene may follow.

The symptoms vary much in different individuals. There is usually a feeling of rawness and burning, with great difficulty and pain in swallowing. The patient often complains of soreness and aching behind the sternum. All the painful symptoms are aggravated by either pressure or motion. The glandular secretions are excited, and large quantities of stringy, glairy mucus are expelled from the esophageal passage. There is at times a febrile reaction, the temperature reaching 100 or 101 degrees. The prognosis is favorable, the disease usually subsiding in a few days. There is danger, however, of its resulting in a chronic condition with ulceration, thickening and stricture of the passage.

TREATMENT. Perfect rest should be enjoined. The agonizing thirst may be relieved by the administration of ice water; cold compresses, or, if more agreeable, hot compresses should be applied to the neck and along the course of the gullet. If the suffering is intense hypodermic injections of morphia, in sufficient quantities to relieve the pain, may be required. Internally such remedies as aconite, belladonna, arsenicum, apis and rhus tox. may be indicated. Only the blandest nourishment should be given by mouth; if the attack is severe the strength should be sustained by rectal enemata alone. Later, when the inflammatory symptoms begin to subside, liquid food may be cautiously given.

Injuries of the Esophagus.—(Traumatic Esophagitis). The most frequent injuries sustained by the esophagus are caused by swallowing corrosive fluids, such as carbolic acid, the mineral acids and the stronger alkalis. These substances are at times taken with suicidal intent, at other times they are taken by mistake. The alkalis are often swallowed by young children. It is a common occurrence for a child to take a drink of concentrated lye through the carelessness of a mother or a servant, the solution having been prepared for washing or scrubbing purposes and thoughtlessly left within reach of the child.

When strong substances have been swallowed the immediate effect is profound collapse. The mouth, fauces, esophagus and stomach are corroded and the patient experiences agonizing pain and distress in those regions. In severe cases there may be a marked absence of suffering, which must be looked upon as a bad omen. The mucous secretions are all excited to a notable degree and the patient vomits large quantities of mucus, more or less streaked with blood and at times shreds of mucous membrane. If death does not soon follow all the symptoms of acute esophagitis supervene, the mouth, fauces and gullet becoming greatly inflamed and a high degree of odor ensuing. The strong mineral acid and corrosive salts through their caustic properties are highly destructive; they corrode the tissue with which they come in contact, producing the most painful symptoms and serious results, while the milder alkaline solutions usually excite only a high degree of acute inflammation with its possible consequences. When the inflammation and swelling commence to subside the process of repair begins. There is a profuse cell proliferation and the abraded or ulcerated surfaces begin to granulate, cicatrization and subsequent contraction following. If the injury has been severe the distortion of the tube may be extensive, the entire length of the gullet being implicated. In milder cases the strictured condition will be confined to the lower segment of the canal. The mineral acids produce tense, unyielding, cicatricial contractions, while those resulting from the milder alkaline solutions are more yielding in their nature.

TREATMENT. If the substance taken is of an acid nature any of the alkalis that can be readily procured may be given in mild solution. If the poison is an alkali, oily substances in quantities should be administered. Phosphorus poisoning is antidoted by carbonate of magnesia administered in drachm doses every fifteen or twenty minutes until the breath ceases to be phosphorescent. The subsequent treatment should be carried out in the line given in acute esophagitis. As soon as the inflammatory symptoms have subsided proper measures should be instituted to prevent the cicatricial narrowing of the canal.

The esophagus is often injured by an accidental traumatism—the swallowing of some sharp substance that inflicts an injury as it passes downward, or a wound from the outside may enter the canal, producing a serious injury. Cases have been reported where a rupture of the gullet has taken place during a severe effort at vomiting.

Tumors of the Esophagus.—Non-malignant growths of the gullet are of rare occurrence. Papillomata are the form most frequently encountered. They are in nature similar to the warty growths found upon the skin, consist of an axis of fibrous tissue, containing blood vessels, and are covered with squamous epithelium. They may be pedunculated or spring from a broad base, and exist singly or in numbers, scattered more or less over the entire mucous lining of the canal. In some cases they give rise to but slight disturbance, while in others they produce the most distressing symptoms, such as pain, dysphagia and great dyspnea.

TREATMENT. The treatment of papillomatous growths may be either medical or surgical. If urgent symptoms do not exist remedial agents should always be tried before operative measures are resorted to. The leading remedies are antimonium crudum, calcarea, causticum, nitric

acid, thuja and sulphur. If the growths are persistent or large, producing distressing symptoms, surgical aid will be demanded. The same operative procedure applies here as in myomata.

Myomata sometimes develop in the esophagus. They are connected with the muscular coat of the canal and consist of unstripped muscular fibres. They are usually ovoid, elongated and may be attached by a long or a slender pedicle. If large in size they produce a circumscribed dilatation of the canal and may cause ulceration and perforation of the walls of the passage. As in warty growths the symptoms may in some cases be of trifling nature, while in others the greatest distress may accompany their presence. When urgent symptoms obtain prompt surgical treatment will be demanded. When the growth is large, and situated in the upper part of the esophagus it may be possible to remove it through the mouth with either a snare or forceps. If this method is found to be impracticable esophagotomy is the only alternative. If the situation is low, gastrotomy will be required. Many tumors have been unwittingly removed from the gullet by the use of Gross' horse-hair probang, the surgeon having applied it under the impression that a foreign body had lodged therein. When a ligature is applied with the view of strangulating the growth care should be observed lest the detachment occur during sleep, and strangulation follow.

Foreign Bodies in the Esophagus.—Innumerable objects have found lodgment in the esophageal passage. Those most frequently met with are morsels of unmasticated food or particles of bone, gristle, fruit-stones, etc., swallowed with the food. Other substances, as false teeth, fish-bones, safety-pins, coin, rings, small stones, in fact almost every object capable of entering the gullet accidentally or by being purposely swallowed, have become impacted therein. The presence of a foreign body in the esophagus may give rise to only slight disturbance, the symptoms depending somewhat upon the shape and size of the object. Mackenzie describes a case in which a half-penny was retained in the esophagus for many years without producing notable inconvenience. Usually when a foreign substance engages in the esophagus urgent symptoms arise, such as extreme dysphagia, dyspnea, spasms of the glottis and gullet, and pain. The patient becomes alarmed and wears an expression of fright and despair. The symptoms may continue unabated or they may subside and reappear with increased severity. If the body be allowed to remain inflammation follows with its train of pathological consequences, such as ulceration, abscess and gangrene. When an abscess forms the pus may burrow beneath the deep cervical fascia and discharge into the pleura or pericardium, or it may perforate the walls of important vessels, as the carotid, subclavian and pulmonary arteries. At times the foreign body may be loosened through the process of ulceration and spontaneously expelled, or it may ulcerate through into the trachea and be coughed up. The position of the foreign body may be ascertained by a physical exploration with the bougie or the stethoscope. The prognosis depends largely upon the size, shape and possibility of removing the foreign body and the amount of injury inflicted by its removal.

TREATMENT. A laudable effort should always be made to effect a delivery of the foreign body by way of the mouth. Sometimes where coins, rings, stones or other heavy and smooth bodies have engaged in

the passage success may attend the act of everting the patient and giving him a sharp slap on the back between the shoulders. Small objects, as fish-bones, pins, etc., can often be caught in the bristle probang of Gross and safely extracted. The instrument should be introduced as an ordinary esophageal bougie, the bristle portion of it resting below the seat of the object to be removed, the instrument then being expanded and gently withdrawn. The expanded surface sweeps the entire surface of the canal and catches in its meshes any substance with which it comes in contact. If resistance is too great the instrument must be allowed to close, lest serious injury be inflicted. Sometimes the coin catcher may be of service, an improvised one made from a large bougie answering every purpose. Large objects, if in reach, should be grasped with the esophageal forceps and extracted. In many instances fish-hooks have been swallowed and become fastened in the walls of the canal. If the line is attached it should be threaded through a hollow tube, the line made taut and the tube glided gently over it until the end engages the hook, when gentle pressure will release it and it can be withdrawn with the tube. If it is found impossible to remove the foreign body by any of these methods it must either be left in its position, pushed into the stomach, or, if high in the cervical region, removed by esophagotomy. If the object cannot be removed and the patient can swallow fluids it is well to leave it in position, hoping that when the spasms of the gullet subside it may be ejected. A sponge probang is the best instrument with which to push the substance into the



Fig. 570.
Sponge Probang.

stomach, (Fig. 570). Large bodies if pushed into the stomach, may have to be removed by gastrotomy.

Esophagotomy.—The operation of esophagotomy was first suggested by Verduc, in the latter part of the seventeenth century. Begen was the first to describe the operation in all its details, although it had been performed long before his time. The operation to be successful must be done early, for it has been clearly proven that recoveries are more frequent in cases operated upon before the sixth day than in those where it is done later. The esophagus begins opposite the cricoid cartilage on a level with the sixth cervical vertebra. In the neck it follows the curve of the cervical spine and also curves laterally to the left. In this region it is in close relation with the trachea, the thyroid gland, the carotid and inferior thyroid arteries, the middle thyroid veins and the recurrent laryngeal nerves. The average caliber of the canal is about twenty mm. at the cricoid cartilage; its narrowest point is but fourteen mm. in breadth.

INSTRUMENTS. In addition to the ordinary instruments used there should be a gag, tongue forceps, esophageal bougie (with metallic or ivory knob) and long-bladed, toothed forceps.

POSITION. The shoulders should be well raised, the head turned to the right side, for the tube, owing to its deflection toward the left, is generally approached from that side, although the position of the foreign body may necessitate an operation from the right side. The surgeon

stands upon the side exposed for operation. Every attempt should have been made to locate the foreign body exactly before the incision is begun, as the cut is influenced by the situation of the body to be removed.

The skin incision, beginning opposite the upper border of the cricoid cartilage, is carried downward along the anterior border of the sterno-mastoid muscle for about three inches (Fig. 571). The skin and platysma having been incised, the deep fascia along the anterior or border of the sterno-mastoid muscle is next divided; the finger is then introduced into the wound and the exact position of the foreign substance defined. The omo-hyoid is drawn downward, or, if necessary, divided. The sterno-thyroid muscles must be drawn aside, and in some cases where the obstruction is very low some fibres of each may require division. The course of the carotid artery is kept in mind, but its sheath must not be disturbed. The

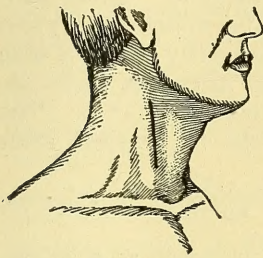


Fig. 571.
Esophagotomy.

Line of Cutaneous Incision.

sterno-mastoid and the large vessels are drawn outward, and the trachea and larynx tilted toward the opposite (inner) side. The position of the tube can now be defined, although some operators at this stage pass a bougie or a pair of esophageal forceps, for the double purpose of accurately ascertaining the course of the tube and locating the impacted body. The inferior thyroid artery and superior thyroid vein must be carefully avoided; the middle thyroid vein generally requires to be double-ligatured and divided (between). After all hemorrhage has been controlled the esophagus is held by a pair of long-bladed, toothed forceps, and opened by a longitudinal incision over the site of the foreign body; this incision should be made through the lateral wall in order to avoid injuring the recurrent laryngeal nerve which runs between the esophagus and trachea. The opening in the tube is then enlarged with a probe-pointed bistoury and the foreign body carefully extracted. When it is of irregular shape and has been long impacted great difficulty may be experienced in its removal.

If the case is of recent date, the foreign body having been impacted for a short time only, and the wound is clean-cut the esophageal incision may be closed—this applies more especially to children and young subjects—with fine sheep-gut sutures which can be most conveniently introduced by means of a curved needle. If the body has been long impacted, or if the wound in the gullet has been lacerated and exposed to much bruising, the use of sutures is to be avoided. In any case of doubt sutures should not be used. The wound in the skin may be narrowed by a few stitches at either end, but the middle or main portion of it should be left open and a suitable-sized drainage tube introduced, well down to the bottom. The open-wound treatment is the great safeguard after esophagotomy. If in a case where the wound in the gullet has been closed and no sign of extravasation occurs for seven or eight days after the operation the superficial structures may, with safety, be brought together, the parts dusted with iodoform and dressed with a plentiful supply of antiseptic gauze, held in position by a light bandage. The neck should then be rigidly fixed with some form of splint to keep the parts

at perfect rest, and the patient be put to bed with the head and shoulders elevated. The administration of food by mouth should be postponed for from forty-eight to seventy-two hours. In the meantime both water and liquid nourishment may be given by enemata. If the thirst be intense small pieces of ice may be taken into the mouth and allowed to melt, but the water should not be swallowed. When food is administered by mouth it must be bland and of liquid form given through a tube. Solid substances should not be taken until healing occurs. The wound has a great tendency to become septic, therefore it should be frequently cleansed with an alkaline antiseptic solution, or a carbolic acid and calendula wash (see formula page 819), dusted with iodoform and covered with gauze. The mouth also should receive careful attention; it should be washed after every feeding.

The causes of death after the operation are septicemia, erysipelas, cellulitis and septic pneumonia.

Esophagectomy.—This operation has been proposed as a substitute for gastrostomy in cases of cancer of the esophagus, but the objections to it are so numerous and pertinent that it has been abandoned.

Esophageomy.—Excision of a portion of the gullet for malignant diseases was first suggested by Billroth. The operation has terminated so unsuccessfully that, like the previous operation, it has not received the sanction of practical surgeons.

Varicose Veins of the Esophagus.—Enlarged veins sometimes occur at the lower and middle part of the gullet, resulting from obstruction of the portal circulation. Hemorrhage from the gullet is spoken of by Galen, and the condition was recognized by Portal in the early part of the present century. Rokitsansky published an instance of fatal hemorrhage from enlarged veins of the esophagus in 1840. The peculiar relations of the veins in the lower part of the gullet to the general circulation and to the Portal system and their large size and vertical course favor congestion. The enlargement exists to a greater degree on the front wall of the canal. Any of the hepatic disorders that obstruct the portal circulation are liable to produce the lesion, though senile atrophy and cirrhosis are the most notable causes.

The diagnosis of the disease is difficult, as the symptoms are not well defined and the hemorrhage must be distinguished from that arising from many other conditions, as hemorrhage from the stomach, the perforation of an aneurism, injury by a foreign body, etc. The diagnosis must be made by exclusion. In recurrent hematemesis in persons past middle age, where liver, heart or kidney diseases exist, varicosis of the esophagus may be suspected. The esophagoscope may be brought into requisition, but it is only in exceptional cases that the desired information can be obtained by it.

TREATMENT. The arrest of the bleeding will first engage the attention of the physician. Astringent remedies should be used; a strong solution of tannic and gallic acids (see formula page 856), may be administered by allowing the patient to sip it slowly. Extract of hamamelis, in teaspoonful doses, may be given internally, and such homeopathic remedies as *millefolium*, *collinsonia*, *erigeron*, *ippecac* and *china*. The curative treatment should be directed to the primary or exciting cause of the malady.

Paralysis of the Esophagus.—Paralysis of the muscular structures of the esophagus may be produced by various causes. It may follow diphtheria, or it may be due to lead or alcohol poisoning. Various lesions of the nerve centers, or nerve pressure, may produce it, or it may arise from muscular weakness consequent to impaired health. Dysphagia is always present and undergoes but little variation. Usually solids are swallowed more easily than fluids and there is seldom regurgitation. The condition must be distinguished from spasms and malignant diseases. The dysphagia in spasms is of an intermittent character and in this condition it is often impossible to pass a bougie. Stricture exists in malignant conditions, but other symptoms are present which render diagnosis easy.

TREATMENT. Treatment must be directed to the malady that produces the paralysis. A nourishing diet should be administered and such attention given to the general health as the exigencies of the case demand. As an auxiliary to the general treatment electricity will often be of great value. Faradization may be applied daily for several weeks, one pole of the battery being applied on the upper cervical region and the other along the interior surface of the esophageal canal, by means of an esophageal electrode.

Spasms or Hysterical Paralysis of the Esophagus.—This condition occurs more commonly in females than in males. Young women of a highly nervous temperament, between the ages of eighteen and thirty, are most frequently subject to it. The disease usually attends such nervous disorders as chorea, epilepsy, hydrophobia, tetanus, etc., or it may be due to reflex irritation, the causative lesion existing in the stomach, uterus, rectum, intestinal canal, mammæ and other organs.

Dysphagia is always present, but it varies in intensity from slight difficulty to almost complete inability to swallow. It is usually paroxysmal, coming on during a meal, but at times it may last for months. Where spasms exist the patient cannot swallow and the food is sometimes regurgitated with great force. In organic stricture the food is returned after an interval; but in spasms the ejection comes on instantly after the act of swallowing. The patient complains many times of slight pain and an uneasy sensation, while globus hystericus is often present. In cases of slight dysphagia solids or semi-solids are more readily swallowed, though usually liquids are taken more easily and warm drinks are better tolerated than cold. In severe cases the patient has little inclination for food, and yet the emaciation is not in proportion to the apparent severity or difficulty in taking food, for many of these subjects will appear nourished.

In passing a bougie the obstruction will generally be encountered near the upper orifice of the gullet, but it may be at the lower. Moderate but steady pressure will frequently overcome the spasm and the bougie can be made to pass, though in other cases it will not yield to any force in moderation. Sometimes a rapid introduction will succeed when the slow passage of the instrument has failed. When doubt exists as to the real condition an anesthetic will clear up the mystery, for the spasms will always yield under its lethal influence. The differential diagnosis must be made between this disease, true paralysis and organic stricture. The age, sex and nervous temperament of the patient must be taken into consideration. The intermittent character of the disease, its abrupt beginning and

termination, the sudden and forcible regurgitation of substances when swallowed, the disproportion that exists between the apparent severity of the disease and the existing emaciation are all factors of importance. In organic stricture the dysphagia is progressive, while in true paralysis it is constant.

The prognosis in mild cases and in the early stages of the disease is usually favorable. When the disease is of long standing pathological changes may result in the canal, incident to the continued contraction, besides which the nervous disorder that superinduces the disease has a tendency to relapse into an intractably chronic state. Cases of death have been reported from spasms of the esophagus in which an autopsy failed to reveal any tangible morbid changes in the structure of the canal. It is highly probable that in these cases the esophageal were reflex manifestations of a diseased condition of some distant organ.

TREATMENT. The medical treatment of spasms of the esophagus must be directed largely to the primary disorder, to the organ at fault. If the nervous system is disordered the treatment must be directed to it, if a gouty or rheumatic habit is the cause the remedies must be selected on this line. If the disease is of reflex origin the organ involved must receive attention. In selecting a remedy it is well to keep in mind the local expressions of the disease; these symptoms will aid in the choice.

Arsenicum has burning pain behind the sternum; worse when swallowing, cramps in the esophagus, food is ejected as soon as it reaches the pharynx, cramp-like pains in the esophagus.

Belladonna has dryness and constriction of the pharynx; painful contractions and spasms of the esophagus: spasms caused by esophageal inflammation.

Hyoscyamus has spasmodic contraction of the esophagus; solid and warm food can be swallowed best, fluids cause spasms; hiccough, nausea, spasmodic cough and stiffness of the muscles of the neck.

Lachesis has sense of constriction about the throat; any attempt to swallow solids causes violent gagging.

Plumbum, fluids can be swallowed without difficulty, solids come back into the mouth; constipation, nervous irritability.

Stramonium has constriction and spasms of the muscles of the throat when attempting to swallow; paralysis of the muscles of the pharynx.

Careful attention must be given to the diet of the patient. The food should be nourishing, bland and liquid. Warm drinks are less liable to bring on spasms than cold and if the food is sweetened it is better borne. Stimulants and pungent food are objectionable. Cream and barley water, the white of an egg stirred in a glass of water, chicken soup, mutton and oyster broths may be mentioned as suitable articles of diet. At times it will be necessary to institute local treatment for the relief of the spasms. Electricity stands at the head of the list in this line and will generally give better results than any of the other forms of local treatment. The positive pole should be applied to some convenient external part of the body, and the negative attached to an esophageal electrode and passed down to the seat of stricture, a current of the strength of from five to fifteen milliamperes being turned on and gentle pressure applied until the spasms yield. The sitting should last from

three to five minutes and be repeated every day until improvement begins, then every other day.

Sometimes benefit will be derived by the daily introduction of an esophageal bougie. This should be well oiled, warmed and gently passed down to the seat of stricture, when steady pressure should be applied until it passes; much force is not admissible.

If there are great hyperesthesia and sensitiveness of the mucous membrane or chronic esophagitis, astringent solutions will be of service; these should be used warm, in mild strength and be applied at the seat of stricture in half-drachm doses every second or third day. The vegetable astringents, such as *pinus*, *canadensis*, tannin and geranium will answer well, but nitrate of silver (one to five grains to the ounce) will be found to be the most efficient.

Compression of the Esophagus.—Tumors springing from the vertebrae, lymphatic glands, cellular tissue or other structures about the esophagus, enlarged or accessory thyroids, peri-esophageal abscesses, aneurism of the aorta, in fact any condition that abnormally encroaches upon the gullet, may produce dysphagia. The condition is not uncommon and the cause is usually apparent, but such is not always the case, for not infrequently aneurisms and abscesses have been ruptured by the incautious passage of a bougie, under the impression that an organic stricture existed. Dysphagia has been caused by a pharyngocele which by its dragging action has displaced the orifice of the esophagus.

Rupture of the Esophagus.—It is probable that in all cases of rupture of the esophagus, not of traumatic origin, some pre-existing morbid condition is present that has weakened the structures of the canal. It may be an ulceration, cicatrix, tubercular, malignant or syphilitic condition. A concomitant factor in rupture is an obstruction at the upper end of the passage, preventing the ready exit of the ingesta, and this may be of the nature of a foreign body, a malignant or organic stricture, or a spasm of the circular fibres in this portion of the canal. Striped muscular fibres cover the upper two-thirds of the canal while its lower portion has only unstriped fibres. This accounts for the predominance of spasmodic stricture in the upper section and the more frequent occurrence of rupture in the lower. The immediate cause of rupture is violent vomiting when the stomach is distended by a full meal, the expulsive power of the organ being reinforced by the diaphragm and abdominal muscles. The accident has followed the administration of an emetic given with a view of dislodging a foreign substance in the esophagus. The rupture occurs in the lower portion of the canal and is usually longitudinal with its axis. The gastric contents are forced out into the mediastinum, or in the pleural cavity and air becomes extravasated into the adjacent cellular tissue (emphysema). During the act of violent vomiting the patient experiences a sensation as though something has given away; becomes faint and blanched, a cold sweat appears on the body and great pain, referred to the course of the esophagus, is complained of. The effort at vomiting suddenly ceases to be effective, though the patient is apparently able to swallow with ease. The suffering is greatly aggravated by motion, therefore the subject usually maintains a half-upright position with the body bent forward. The diagnosis is difficult. The true nature of the malady is usually revealed by

the autopsy. The prognosis is unfavorable, all reported cases, with one or two exceptions, having died within a few hours after the occurrence of the rupture.

Dilatation of the Esophagus.—This may occur as a primary lesion, or result from a stricture of the canal, or it may be produced by traction to an adjacent cicatrix.

Primary dilatation is a rare form of disease. It is generally met with in delicate young subjects and is produced by a prolonged general or muscular weakness. The expansion involves the whole circumference of the canal and usually extends its entire length. In shape it may be cylindrical or fusiform, and in most cases attains its greatest dimensions in the thoracic region. Patients so afflicted suffer from regurgitation of food which comes on some hours after eating. The ingesta expelled are either alkaline or neutral in reaction and if they contain starchy matter are sweetish in taste, digestive action not having affected them. Substances have been returned four or five days after they were taken without having undergone any change. The food when retained long in the esophagus becomes decomposed and gives off a fetid odor that contaminates the breath of the subject. The salivary secretions are usually greatly augmented and the patient is continuously spitting. Various sensations of discomfort exist and the patient often complains of a feeling of great distress, which is relieved only by vomiting. The progress of the disease is slow, generally extending over a period of several years. Diagnosis must be made by exclusion. The ready passage of a bougie and the unaltered state of the ejected food are prime factors in forming a conclusion. Prognosis is unfavorable, so far as a cure is concerned. Medical treatment should be directed to any constitutional dyscrasia that may exist. The faithful application of faradization to the distended portion of the canal should be instituted and the diet should receive the most careful consideration.

Secondary dilatations are the result of obstructions and will be considered under the head of strictures of the esophagus.

Sacciform dilatation is treated in the section on Malformation of the Pharynx and Esophagus.

Traction diverticula usually exist on the anterior wall of the esophagus at a point opposite or near to the bifurcation of the trachea. They are generally conical in shape, project forward and are of variable size, seldom exceeding ten or twelve mm. in length. They probably begin in childhood and are about equally divided as to the sexes. Their origin is in diseased lymphatic glands, the inflammation spreading from the glands to the peri-esophageal areolar tissue. The cicatricial contraction that follows the disintegration of the gland draws the wall of the gullet out and forms the sac; however, peri-esophageal contraction from any cause may produce it. This form of diverticula seldom gives rise to any symptoms.

Malignant Diseases of the Esophagus.—Epithelioma is the most frequent form of malignant neoplasm found in the esophagus. It differs from the non-malignant warty growth in the fact that the epithelium is no longer limited by a basement membrane but passes into the underlying connective tissue. It is peculiarly liable to a recurrence after removal and early infects the neighboring glands. It occurs between

the ages of forty and sixty years and exists much more frequently in males than in females. The favorite seat of election is where the calibre of the canal is smallest and the walls are most rigid, viz., at the level of the cricoid cartilage, where it is crossed by the left bronchus and at its termination. No portion is exempt. The disease runs a rapid course and usually terminates within a year after the first manifestation of symptoms; the early stages are free from subjective symptoms; it is only after the neighboring structures become involved or the functional impairment begins that the patient complains. Owing to this fact but little is known of the earlier stages of the disease. The first notable symptoms are those incident to obstruction. The inability of the patient to swallow substantial food soon gives rise to inanition and exhaustion. Mediastinal abscess, perforation of the pleura, fistulæ between the esophagus and trachea and paralysis of the laryngeal muscles may be numbered among the sequelæ. Pain is not usually severe and with rare exceptions there is no external tumor present. Glandular complications are not constant. The glands at the root of the neck and in the mediastinum are most prone to become affected, though distant ones may be the seat of infection.

TREATMENT. Owing to the anatomical relations of the esophagus, operative treatment for the total extirpation of the growth has not proven successful. Rectal alimentation and gastrostomy offer the only means of prolonging life. With one who has practically experienced the disappointment of gastrostomy it does not stand in high repute, yet there are no other means of prolonging life.

SARCOMATA. These have occasionally been found in the gullet.

Stricture of the Esophagus.—Stricture of the esophagus may be of congenital, malignant, syphilitic or cicatricial origin. In congenital narrowing of the gullet there is usually an absence of pathological changes in the structures of the canal. The constriction may be due to an arrest of a growth in the early stages of infantile life or to paralysis of the muscular fibres. When the constriction occurs low in the passage there may be considerable dilatation above it. The long continued irritation produced by the presence of food in the dilated portion above the stricture has a tendency to cause disease at this point, such as general inflammation, polypoid growths and carcinomatous degeneration.

DIAGNOSIS. Certain subjective symptoms of stricture are always present. While liquids are usually swallowed with ease, solids are difficult to manage; if taken at all, they must be washed down with fluids. The dysphagia dates back to the early life of the patient and is progressive in its course. This taken in conjunction with an absence of a traumatic history serves to designate the form of stricture. A sacculated dilatation above the contraction is indicated by the tendency to a regurgitation of food.

PROGNOSIS. The prognosis is not unfavorable, as patients, though compelled to subsist on liquid food, have lived to a ripe old age.

The management of simple stenosis of the gullet is largely confined to a careful consideration of dietetic principles. The patient should be confined to a nutritious but non-irritating liquid or semi-liquid diet; since the trouble is of life's duration, nothing should be taken that is liable to produce an irritation, with its consequent morbid possibilities in the dilated portion of the canal above the stricture.

These cases are not amenable to dilatation or electrolysis. If the constriction is so grave that operative treatment is demanded esophagotomy or gastrostomy is the only legitimate procedure.

Malignant Stricture.—Epithelioma is the form of malignant neoplasm that is almost universally encountered in the esophagus. The disease primarily involves the deeper layers of the mucosa and soon involves the entire structure of the canal. The muscular coats become thickened for some distance above the seat of disease. The surface of the growth is irregular, deeply ulcerated and exudes an offensive, sanious discharge. The stenosis may be caused by the everted and thickened edges of the ulcers, by a general hypertrophied condition of the walls of the passage, or by the nodular projections of the tumor. The first symptom is difficulty in swallowing. This appears as a secondary manifestation of the disease, after it has advanced sufficiently to encroach upon the lumen of the canal. The course of the malady is progressive and other symptoms, peculiar to malignancy, rapidly develop. The differentiation must be made from syphilitic, spasmodic or cicatricial stricture, paralysis of the esophagus or simple dilatation.

TREATMENT. Treatment of malignant stricture of the esophagus consists largely in an intelligent effort to prolong life and alleviate suffering. Strict attention should be given to the patient's diet; nothing should be administered that is in any way irritating to the diseased passage; therefore the food must be bland, nourishing and easily digested. Milk, cream and barley water, eggs, oysters, animal broths and soft farinaceous foods should be administered. Dilatation with bougies is disappointing and injurious, nor is the feeding tube more worthy of consideration. When the constriction becomes so great that sufficient nourishment cannot be taken to maintain the strength, before the stomach has become contracted, or the patient too greatly emaciated, either Von Hacker's, Witzel's or the Ssabanejew-Frank method of gastrostomy should be performed. These operations are described under their proper headings.

Syphilitic Stricture of the Esophagus.—The insidious nature of syphilis leaves no part of the human body exempt from its ravages. While the esophagus is rarely affected it sometimes becomes the seat of secondary or tertiary developments of the disease. The morbid changes consist of simple ulceration of the mucous membrane, or a gummy deposit in the sub-mucous tissue, which may break down and leave a deep ulcerative surface. The contraction incident to cicatrization may produce extensive strictures in the passage. In some cases the gummy deposits may extend over a large area, producing a great amount of infiltration and thickening in the walls of the canal. Fig. 572 shows an aggravated type of syphilitic stricture. On one side of the wall the thickening was so great that it gave the appearance of a diverticulum. Upon examination, however, it proved to be a case of gumma deposit, infiltration and thickening of the mucous and sub-mucous tissue. The mucosa was soft, and in spots was breaking down.

The symptoms are like those of ordinary stricture, and a diagnosis is made by a careful study of the history of the case. All forms of syphilitic manifestations should be taken into consideration and a thorough

investigation made as to the previous existence of primary or secondary lesions.

The prognosis is usually not favorable. Recurrences are frequent, and the tendency is to the formation of permanent stricture.

TREATMENT. The successful management of a case of syphilitic stricture of the esophagus depends largely upon the internal administration of the proper constitutional remedies. The same therapeutical indications govern the administration of remedies here as when the disease exists in other portions of the body. The mercurial preparations, arsenicum, aurum, kali bichroicum, kali hydriodicum, meze-reum, nitric acid and thuja are the remedies to select from. In the tertiary stage of the disease where the gummata exist the iodide of potassium or sodium, given in tangible doses, three to ten grains in water every three hours, will bring about a rapid improvement in the symptoms and if continued for a length of time will permanently dissipate them. The remedies should be persistently given for weeks or even months after every local manifestation of the disease has disappeared. The mechanical treatment of the constriction must be conducted on the lines indicated in cicatricial stricture of the esophagus.

Cicatricial Stricture of the Esophagus.—

This may arise from any cause which produces ulceration or sloughing of the mucous membrane, or sub-mucous tissue, with consequent cicatricial contractions. The condition most frequently arises from swallowing strong solutions of caustic substances, as concentrated lye, the mineral acids, etc. The accident occurs most frequently in children between the ages of one and three years. The strictures are usually multiple and occupy the lower third of the tube, though they are not infrequently found in the upper portion. When the substance swallowed has been of a strongly corrosive nature and a considerable quantity of it has been taken the entire length of the canal may be obliterated. The presence of the irritant causes spasms of the esophageal muscles and the fluid is often, in this way, prevented from entering the stomach. The same principle often prevents its immediate ejection after it has once entered the gullet; this accounts for the more frequent presence of the stricture in the lower third of the canal when the weaker alkaline substances have been taken. The upper section of the canal being more freely supplied with striped muscular fibres the contraction occurs here and the fluids are held, as it were, for a time in the lower segment of the canal, until greater injury is sustained there. In six cases of esophageal stricture in children treated by the author, caused by taking solutions of concentrated lye, the strictures were located in the lower segment of the canal. The contractions vary in form according to the character and

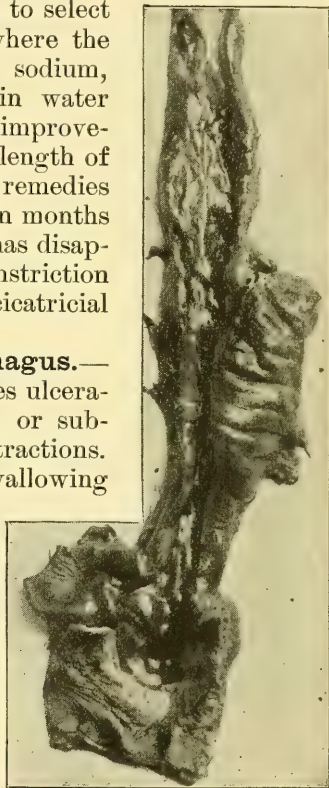


Fig. 572.
Syphilitic Stricture of Esophagus, showing Gummy Deposit and Thickening of Walls.

extent of the ulceration. The cicatrix may run in any direction, distorting and occluding the canal. There is usually considerable inflammatory thickening in the walls of the esophagus (Fig. 573), which probably accounts for the fact that there is seldom dilatation above the seat of stricture.

SYMPTOMS. Dysphagia is present in all cases of stricture and is a characteristic symptom. It varies in degree according to the amount of constriction. The difficulty in swallowing is often aggravated by the spasmodic contractions of the circular fibres of the canal. During the earlier stages of the injury, the inflammatory period, severe pain is often experienced; this and the difficulty of swallowing grow less as the inflammation subsides and the ulceration heals, but as cicatrization progresses the dysphagia returns and grows worse in proportion to the degree of contraction. When the fluid swallowed is of a strongly corrosive nature there is but little amelioration in the dysphagia; it rapidly grows worse and alarming symptoms soon develop.

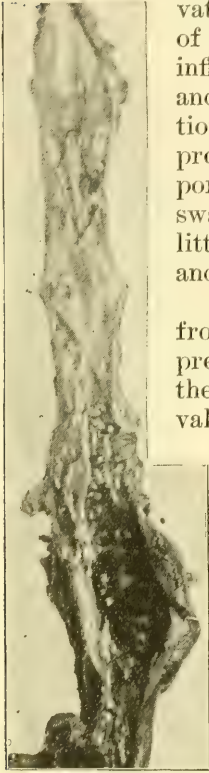


Fig. 573.
Multiple Cicatricial Stricture of Esophagus.

DIAGNOSIS. Cicatricial stricture must be differentiated from simple spasmodic and malignant strictures and compression of the gullet. Diagnosis is rendered certain by the passage of a bougie, other methods being of but little value. If the patient is an adult he should be placed in a straight-back chair and his head supported by an assistant. If a child it should be taken firmly between the knees of the assistant and its head supported by placing one hand against its forehead and the other against the back of the neck, elevating the chin and straightening the cervical spine. The surgeon selects a large-sized (No. 30 F.), flexible urethral bougie, warms it by dipping in warm water, lubricates it with glycerine, and bends the point forward. He now takes a position in front of the patient, and, if a child, forces a large cork or gag between the teeth, places his left index finger over the base of the tongue, depresses it, while with the right hand he glides the instrument back into the throat and passes it gently down the gullet until it meets with an impassable

obstruction. But little pressure should be used, as injury may be done in trying to force a passage of the instrument. Having located the stricture, smaller instruments are selected and introduced until one is found that will pass through into the stomach. Often two, three and even more strictures will be noticed.

PROGNOSIS. Recovery from stricture of the esophagus depends largely upon the strength of the chemical substance swallowed, the length of time that cicatrization has been progressing, age of the patient and the mode of treatment used for its cure. Those cases caused by mild alkaline solutions are more tractable in character than those produced by the strong mineral acids.

TREATMENT. Medical treatment can have but little effect in the

management of cicatricial stricture. The food given should be non-irritating, nourishing and easily digested.

The methods of overcoming the constriction are gradual dilatation, forcible dilatation and internal esophagotomy. Gradual dilatation, when applicable, will give the most satisfactory results. The curative action of mechanical pressure, by promoting absorption, is strikingly exemplified in the treatment of stricture by this method. The end sought is the removal of the adventitious deposit; this is obtained by the force applied to the diseased structures through the medium of the bougie. By this process pressure is brought to bear upon the stenosed tissue, stretching and temporarily paralyzing its fibres, thereby stimulating absorption. During the operation slight divulsion of the mucous membrane may occur, causing some hemorrhage, which need not excite anxiety, as the chasm will fill up by healthy granulations and in so doing materially aid in restoring the calibre of the canal to its normal dimensions. In a few hours after the introduction of the instrument swelling and extravasation will ensue, but at the expiration of forty-eight hours absorption will begin. This is nature's mode of repair, which has received a stimulus by the injury inflicted. The process of improvement will continue for several days, when if the operation be not repeated, the symptoms will again become aggravated. Therefore at the end of the third to the fifth day—not sooner—the instrument should be again introduced, the operator choosing one of a somewhat larger dimension than that used on the previous occasion. After the bougie has been firmly, but gently, pressed through the entire length of the gullet into the stomach it should be slowly withdrawn. Its retention for any length of time does not materially expedite the cure, but only inflicts unnecessary distress. After the normal calibre of the passage has been fully restored the introduction of the dilator may be continued at longer intervals, and for months, until all tendency to recontraction of the walls of the canal ceases.

In the early stage of the treatment, when the calibre of the stricture is small and soft bougies are being used, two, three and even more instruments of graded sizes may be introduced in succession at the same sitting. By this means a more rapid curative result may be obtained. The ordinary esophageal bougies are not suitable for the treatment of stricture in children; they are too stiff and inflict too much pain. The urethral instrument is better, being more flexible. When the contraction has been brought up to the largest size of these an instrument may be improvised by taking a No. 20 to 30 F., flexible bougie and beginning one inch from its tip, roughening it and firmly wrapping it with cotton over a space extending backward one and one-quarter inches, increasing it until the desired size is reached, giving it an oval shape. This entire surface is painted over with collodion, which on drying contracts upon the wrapping, insuring firmness of attachment and giving solidity to the structure. It is then dipped in bees-wax until a smooth and even surface is obtained. If necessary, to give additional stiffness, a common English catheter is inserted in the hollow of the bougie. With this simple contrivance, which can be increased in size by an additional coating of wax to suit the requirements of improvement, the treatment can be continued to complete recovery.

In the adult almost any of the late forms of esophageal bougie will answer. The metal tipped will answer well. When the fibres of the stricture are tough and inelastic in nature they will not yield to dilatation and some other mode of treatment will have to be instituted. Electrolysis may prove of great benefit in some such cases. The method has warm advocates and marvelous cures from its use have been reported. Definite knowledge in electro-chemistry, electro-technique and necessary experience in the working of batteries are essential in its application. This mode of treatment is not applicable in small children, as they are so intractable and difficult to manage that the electrodes cannot be held in place sufficiently long to accomplish the purpose. The procedure can be used only when the patient will submissively and intelligently aid the operator.

If all the milder methods of treatment fail the more formidable surgical operations must be resorted to. If the stricture is situated near the cardiac orifice gastrotomy should be performed, and the contraction forcibly dilated either with the finger or an instrument. An Otis urethrotome has been used for the purpose. After the dilatation has been effected a ligature may be passed by way of the mouth through the gastric opening and secured to a plug of gauze, which is drawn tightly into the stricture. The free end of the ligature protruding from the mouth may be fastened around the neck. (A sawing, or to and fro, motion of the string, one end drawn through the gastric wound, the other held within the mouth, has been resorted to as a means of cutting the stricture). The wounds in the stomach and abdomen are closed as in ordinary gastrotomy. The gauze may be removed with the ligature in six to twelve hours and the patency of the canal maintained by the passage of the bougie by way of the mouth at stated intervals. If the stricture exists high up divulsion or esophagotomy should be performed for its cure. If all other efforts fail there is nothing left to the surgeon but gastrostomy, with the hope of prolonging life and insuring some degree of comfort to the patient while he lives.

CHAPTER VII.

SURGICAL DISEASES OF THE STOMACH.

Topography.—The stomach is situated in the left hypochondriac and epigastric regions, the major part resting behind the cartilages of the fifth and sixth ribs. It lies behind the anterior walls of the abdomen, above the transverse colon and below the liver and diaphragm. The left extremity or fundus, the largest part of the organ, is situated behind the lower ribs and is in contact with the spleen, to which it is connected by the gastro-splenic omentum. The right or pyloric end is the smaller of the two. It lies in contact with the anterior walls of the abdomen and the under surface of the liver, and extends, when moderately filled, somewhat to the right of the median line. The anterior surface is directed upward and forward, and is in relation with the diaphragm, the left lobe of the liver and the abdominal parietes. When ordinarily distended its lower limits are on a level with the tip of the cartilage of the tenth rib, but when empty it retracts behind the bony walls of the upper abdomen, occupying only a small portion of the left hypochondrium and lying beneath the left lobe of the liver. The stomach is held in position by the lesser omentum and a fold of peritoneum, which passes from the diaphragm to the esophageal end of the organ. The greater omentum is attached to its greater curvature. The lesser omentum contains in its folds the gastric artery, which is the chief blood supply of the stomach, and the hepatic artery, and also passes upward between the layers of the lesser omentum. It gives off to supply the stomach the pyloric, which descends to the pyloric extremity, and passes from right to left along its lesser curvature, and the gastro-epiploica-dextra, which also courses from right to left and runs along the greater curvature. This artery is in anastomosis with a branch of the splenic, the gastro-epiploica sinistra. The portal vein and common bile duct are also connected with the lesser omentum, the duct lying to the right of the hepatic artery and the vein behind it. All these structures and their relations must be kept in mind when performing operations upon the stomach; though, owing to the great vascularity and intimate anastomosis that exists the danger of imperiling the vitality of structures when manipulating here is not so great as it is when dealing with the intestines.

Ulcer of the Stomach.—This disease becomes a subject of importance to the surgeon on account of recurrent hemorrhages, that at times threaten life, and the cicatricial contractions incident to the process of healing. Ulceration usually occurs along the lesser curvature—the anastomosis here not being so perfect as in other portions of the organ—and is the result of an interruption of the blood current, an obstruction of a terminal artery. The blocking up of the vessel produces an area of ischemia which terminates in necrosis of the structures, an ulceration. The sloughing tissue does not show evidence of inflammatory action, but indicates molecular decay. Usually but a single ulcer is present, though

in exceptional cases there may be more. In size it varies from that of a split pea to a dime, may present either a round or oval appearance, and is cone-like in shape, the base being at the mucous surface. The ulcer may heal in any of its stages, producing a radiating cicatrix. When the seat of the lesion is near the pylorus a fibrous constriction of this orifice sometimes results. At times the ulcer perforates the walls of the stomach and allows the contents to be injected into the abdominal cavity. In such cases if the condition is not promptly and properly met by surgical measures a septic peritonitis rapidly develops which proves fatal in from two to three days. Perforation is frequently prevented through inflammatory action and the rapidity by which serous surfaces adhere, plastic exudation being thrown out and the walls of the stomach becoming firmly attached to adjacent structures.

The symptoms of gastric ulcer are usually referable to the region of the stomach. They consist of local pains that often radiate to the spine, coming on in paroxysms—generally after eating—soreness in the epigastrium, and vomiting, manifested after food is taken without previous nausea. The substance thrown up is usually acrid, sour and contains particles of food. There is more or less hemoptysis without the objective symptoms of cancer.

MEDICAL TREATMENT. The rational management of gastric ulcer may require both therapeutical and surgical measures. The diet should be bland, digestible and nourishing, taken in small quantities, so as not to over-distend the organ, and at short intervals. Lavage should be regularly instituted and some medicinal substance, such as borax, hydrastis or pinus canadensis, may be added to the wash. The internal remedies most useful to promote the healing of the ulcer are argentum nitricum, arsenicum, carbo vegetabilis, kali muriaticum, nux vomica and phosphorus.

Argentum nitricum. Circumscribed pain, aggravated by pressure, vomiting of much stringy mucus.

Arsenicum. Much thirst, burning pain in the stomach, vomiting of dark, grumous matter, pain worse after eating or drinking, prostration and emaciation.

Carbo vegetabilis. Dry tongue, vomiting of sour fluid, burning in the stomach, eructation of sour fluid, constipation, coldness of extremities.

Kali bichromicum. Vomiting of sour, undigested food, vomiting of stringy, glairy mucus, burning in the stomach, tongue coated yellow, especially at the base.

Kali muriaticum. Tongue coated white, constant spitting of whitish phlegm, ulcers in the mouth, loss of appetite, nausea and vomiting of white mucus, constipation, stools light-colored.

Nux vomica. Nausea and vomiting of sour fluid, eructations, bowels constipated, patient irritable and fretful.

Phosphorus. Vomiting of fluids as soon as they become warm in the stomach, bloated feeling in the abdomen, excessive acidity, flatulence and constipation.

SURGICAL TREATMENT. The surgical treatment of ulceration of the stomach was first instituted by Rydygier. The demand for its application is either in the arrest of a severe hemorrhage by the excision of the ulcer from which it springs, or the closure of a perforation. When

repeated attacks of hemorrhage threaten life an effort should be made to stop it by laparotomy. If symptoms of perforation exist its presence may be demonstrated by the insufflation of hydrogen gas through an esophageal tube. When the operation is done for an ulceration, the seat of the lesion may be located by the circumscribed area of peritoneal inflammation, which corresponds to its position on the internal walls. Since the smaller curvature in the region of the cardiac or pyloric orifice is the usual seat of such lesions the first search for the trouble should be made here. If the lesion exists in the anterior wall the surgical process is simple indeed—the diseased area is excised and the resulting wound closed as in perforation; but if the ulcer is located in the posterior wall an opening must first be made in the anterior wall, the stomach be well emptied and irrigated, and the ulcer located and excised. The peritoneal or superficial sutures are first applied and then the deeper ones, which include the mucous membrane and muscular coats. The anterior wound, through which the search was made, is then closed by reversing the order, viz., the first row includes the muscular and mucous coats, while the second embraces the peritoneal, as in gastrotomy. After the operation all feeding through the stomach is withheld for four or five days and the patient is sustained by rectal alimentation.

Excision of an ulcer of the stomach puts to rest all the remote possibilities of ulceration, as hemorrhage, cicatricial contractions, peritonitis, etc.

Cicatricial Stenosis of Orifices of Stomach.—Cicatricial contractions at either orifice of the stomach may follow the healing of an ulcer or they may result from traumatism. The action of the gastric fluid and the irritation of the food passing over the injured surfaces during the process of digestion interfere with the proper healing of wounds or injuries, causing a proliferation of granulations and consequent increased tendency to cicatrization and contraction. When the stenosis is situated at the cardiac extremity the introduction of food is interfered with, while if the pyloric end is the seat of the lesion the escape of the gastric contents into the intestinal tract is impeded.

DIAGNOSIS. When a stricture occurs at the cardiac orifice of the stomach the history of the case will often throw considerable light upon the subject. The deleterious action of swallowed caustic substances frequently exerts its baneful influence at this point; injury may also be sustained here by the lodgment of a foreign body or by an attempt at its removal. In such cases there arise the ordinary symptoms of esophageal obstruction. There is at first difficulty in swallowing solids, and, later, liquids will be tardy in passing the constriction. The passage above the seat of obstruction becomes dilated and solid food is rejected after having been taken. The diagnosis is confirmed by an exploration with the esophageal bougie, the same as in stricture of that passage. The condition must be differentiated from carcinoma or malignant disease of this region.

A cicatricial stricture at the pyloric orifice is more difficult to diagnose. The condition is often mistaken for other lesions of the viscus, such as gastric catarrh, chronic indigestion, etc. The stomach gradually becomes dilated, sometimes to such an extent that large quantities of food are retained, digestion is impaired and a general feeling of discom-

fort obtains. In the earlier stages compensatory hypertrophy exists, and the gastric contents, though they pass slowly, are gradually expelled through the constricted opening. Later the walls become thinned and the coats enormously distended, which is noticeable through the abdominal walls. The boundaries of the enlarged organ may be imperfectly outlined by percussion. The introduction of the stomach tube will reveal the large accumulation of injeſta, and throw valuable light upon the diagnosis. The contents of the stomach may be ſyphoned out and its cavity filled with warm water. In this way by filling the stomach an approximate estimate of its capacity may be made. In malignant ſtenoſis, the ſame degree of dilatation often obtains, but in this diſeaſe there is uſually a perceptible tumor or enlargement at the ſeat of obſtruction.

As a natural conſequence of ſtenoſis at either extremity of the ſtomach gradual emaciation follows, and if not relieved the patient ultimately dies of maraſmuſ.

TREATMENT. The management of a cicatricial ſtenoſis at the cardiac inlet is by dilatation, either carried out gradually by way of the gullet by means of the bougie, as in eſophageal ſtricture, or, if the contraction proves intractable to this method, from below through an opening made in the ſtomach wall (Gastroſtomy). The opening in the abdominal parietes ſhould be made after the Fenger method. The gastric contents are evacuated and the cavity thoroughly irrigated; graded bougies may then be paſſed one after another until the ſtructure is dilated as much as poſſible within the bounds of ſafety, or the dilatation may be accompliſhed with an Otis urethrotome. After the conſtriction has been overcome a bougie ſhould be paſſed by way of the mouth until it enters the ſtomach, to inſure patency by this route. The gastric and abdominal wounds are then cloſed. Within four or five days the dilatation ſhould be cauſtically done through the eſophagus by means of the bougie and perſiſtently conducted through this paſſage. If the ſtricture is found to be alſo impervious by this route the gastric walls ſhould be attached to the abdominal opening, making a gastroſtomy, and the patient's ſtrength maintained by feeding through the reſultant fiſtula.

When a ſtenoſis exiſts at the pyloric orifice it can be reached only through an abdominal ſection. Profeſſor Loreta, of Bologna, in 1882, was the firſt to perform the operation of dilating a ſtricture at the pylorus through an opening made in the walls of the ſtomach. It is reported that he did the operation in more than thirty caſes; other ſurgeons of prominence have many times ſucceſſfully performed it.

The abdomen is opened in the median line and the ſtomach incised ſomewhat nearer the pyloric than the cardiac extremity. Owing to the great dilatation of the organ there may be ſome difficulty experienced in defining the outlet. The tip of the index finger of the right hand ſhould firſt be inſinuated through the conſtriction, then the middle and index fingers may be cauſtically paſſed together, care being taken not to rupture the walls of the organ. The opening need not be increased over the circumference of the two fingers, as this exceeds the natural ſize.

If this procedure is not deemed feaſible the paſſage ſhould be enlarged by Heineke-Mickulicz' pylora-plaſtic operation, deſcribed on page 895, or by making a gastro-enteroſtomy, inſtituting a new outlet (ſee page 897.)

Dilatation of the Stomach.—Chronic catarrhal inflammation of the stomach sometimes results in dilatation of the organ when pyloric stenosis does not exist. The irritation incident to the inflammation causes a hyper-secretion of the gastric fluids, this in conjunction with the constant presence of a large amount of undigested food causing a gradual thinning and distension of the walls of the organ. The usual symptoms of gastric enlargement exist, the area of gastric dullness is increased and the boundaries of the distended organ may be outlined by percussion.

TREATMENT. In the management of a case of dilatation of the stomach careful attention must be given to hygienic and dietetic measures, as well as to therapeutical. Healthful outdoor exercise and daily baths with friction should be advised, a nutritious and digestible diet selected and such drugs prescribed as will promote digestion. The stomach should be daily irrigated by means of a soft rubber tube (page 888), after which it may be washed with some mildly antiseptic solution. The formula given on page 827 is probably one of the very best; however, a solution of chloride of sodium, one teaspoonful to the pint, will answer well. The application of electricity sometimes gives good results. In applying this the stomach should first be filled with a warm salt-water solution; then an insulated esophageal bougie attached to the negative pole of a galvanic battery should be passed down into the stomach. A large metal dispersing electrode connected with the positive pole is placed over the epigastrium, and a current of from fifteen to thirty-five milliamperes is then turned on and allowed to run for ten minutes. This operation may be repeated every second day. If favorable results do not follow this course of treatment the operation of Bercher and Weir may be tried, which has been favorably reported upon. It consists in uniting the greater curvature to the lesser by several rows of sutures. Gastro-enterostomy has been advised for the same purpose (page 897).

Carcinoma.—The stomach is almost totally exempt from the various malignant neoplasms that affect other portions of the human body, save carcinoma. This disease frequently invades the organ, the pyloric and cardiac extremities being the usual points of origin; of the two the former is more liable to be attacked. The initial seat of involvement is in the mucous membrane, from which it spreads by infiltration to the muscular coat and, at times, to the serous. When the latter becomes involved inflammatory adhesions form between the stomach and adjacent viscera, the liver, spleen, pancreas and colon. When extensive ulceration exists these structures may constitute part of its walls. Occasionally the disease is limited in its extent to an area about the pylorus, and again it may extend downward along the duodenum; but it most frequently travels upward in the direction of the lesser curvature. When the point of primary infection is at the cardiac end the esophagus becomes early implicated and a stricture of that passage with all its attendant symptoms results. In such cases, owing to the inability of the patient to swallow sufficient food, the cavity of the stomach gradually diminishes, and if adhesions to the surrounding structures have not formed the organ retracts well up behind the walls of the upper abdomen. When the seat of origin is at the right extremity of the stomach the infiltration of tissue leads to a closure of the pyloric outlet, which may be extreme. When this occurs the organ becomes greatly distended

and often sinks, from its increased weight, low down into the abdominal cavity. The mucous surface over and about the morbid growth, in the early stages of the trouble, presents all the characteristics of a catarrhal inflammation; later, as the disease advances, abrasions and ulcerations form which bleed more or less constantly, and at times the erosion of a blood vessel may result in a veritable hemorrhage that may be sufficiently profuse to terminate life in a few moments. Cancer of the stomach rapidly disseminates, and secondary points of infection soon appear in the liver and lungs, and it may be in the ovaries, skin and other structures. The lymphatic glands in the gastro-hepatic omentum become infiltrated in more than half the cases. Those in the lumbar region are occasionally affected and exceptionally the glands in the neck, groin and axilla enlarge.

The disease is seldom seen in patients under thirty years of age, and most often occurs between the ages of forty and sixty. It runs a rapid course, and terminates life in from six to twelve months from its first symptomatic manifestation.

Death may occur from various causes. It may be due to hemorrhage, exhaustion, general septicemia, or septic peritonitis and pleuritis, resulting from perforation into the peritoneal or pleural cavities.

SYMPTOMS. The more prominent characteristics of cancer of the stomach are usually preceded by a train of symptoms not dissimilar to those of chronic gastric catarrh. The pathognomonic indications of the disease develop later. These are nausea and vomiting, hemorrhage, pain, emaciation and general cachexia.

The nausea is usually more or less constant, while the vomiting comes on at irregular intervals, generally when the pylorus is affected, three or four hours after meals, and consists of partially digested food in a state of fermentation and more or less mixed with blood. The pain is situated in the epigastrium, is of a lancinating character, and is aggravated by eating, often preventing the patient's taking food. The hemorrhages vary in quantity, and the blood thrown up may be acted upon by the gastric juices, when it presents a brownish, chocolate or coffee-grounds color; when it is profuse, from the erosion of a vessel, it may come up unaffected and clear. The stools in the early stages may be more or less constipated, but later, after the cancerous structures begin to soften, they are mushy, dark and tar-like or colliquative. When the morbid growth invades the pylorus a tumor is often distinguishable. It presents as a roundish, irregular induration, situated to the right and above the umbilicus. If adhesions have formed the enlargement is stationary, but if not it gradually sinks into the confines of the lower abdomen. Its boundaries may be outlined by percussion. The tumor may at times be covered by the left lobe of the liver, or a distended colon, when its detection is attended with difficulty. The existence of a cancerous product at the cardiac end is followed by a rapid closure of this orifice. The condition can be diagnosed by means of the esophageal bougie. The food that is taken is immediately returned unchanged by the gastric fluid, without nausea or exertion, and, consequently, the size of the stomach is greatly reduced. The disease must be differentiated from chronic gastric catarrh, ulcer of the stomach, chronic duodenitis, malignant growths of the pancreas and retro-peritoneal tumors.

The history of the case, age of the patient, dilatation or contraction of the organ, according to the part affected, hemorrhage and consequent glandular affection are all points of importance. The chemical and microscopical examination of the contents of the stomach may at times aid in solving the mystery.

TREATMENT. This consists of dietetic, palliative and surgical measures. Nourishing food in form and substance that can be taken should be regularly administered, and such remedies prescribed as will hold the disease in check and palliate the suffering.

Arsenicum. Burning pain in the stomach, better from warm drinks, vomiting of dark substances, restlessness, emaciation and prostration.

Bismuth. Burning and stinging pains in the stomach, rumbling of gases along the colon, bloated abdomen, vomiting at intervals.

Carbo vegetabilis. Burning pain in the stomach, extending into the small of the back, anxiety, cold perspiration, weak, intermittent pulse.

Lycopodium. Bloated feeling in the bowels, feeling of distension, cannot bear the clothes tight, rumbling in the bowels, much gas, obstinate constipation.

Phosphorus. Sensitiveness of epigastrium, constant nausea and fullness of the stomach, vomiting of sour-smelling fluid, vomiting of dark coffee-grounds-looking substance, vomiting immediately after drink is taken; bowels constipated, dry, hard stools.

Much relief may be obtained by frequently washing out the stomach either with warm salt water or with a mild antiseptic solution, the formula of which is given on page 827. This may be diluted with four to six parts of water. Irrigating the stomach not only lessens the septic decomposition and fermentation that are constantly going on but it greatly alleviates the pain and often relieves the constipation. The process should be repeated once or twice daily. (See Lavage, page 888.)

When the cardiac orifice is affected its closure may be prevented as long as possible by the careful introduction of soft bougies; however, this is of doubtful utility, as the irritation produced by the constant passage of the instrument increases the morbid growth and inflicts more or less pain. Some of the modern forms of gastrostomy should be done early and the patient be fed through the fistulous opening.

When a diagnosis of cancer of the pylorus is made early, while the disease is limited in its extension, pylorectomy may be performed (see operations on the stomach). When the walls are extensively infiltrated and adjacent structures are involved temporary relief will be obtained only by an anastomosis with the intestine, thereby establishing a new outlet.

Bernays of St. Louis, in the "Annals of Surgery," December, 1887, describes an operation which he devised for the treatment of carcinoma by curettement. In consideration of the fact that carcinoma develops primarily in the mucous tissue of the gastric walls he advocates the feasibility of attacking the disease locally before extensive infiltration has taken place and adjacent organs have been infected. He exposes the organ as in the operation of gastrotomy, and unites its serous coat to the abdominal peritoneum and muscles by sutures, after which an opening one and one-half inches long is made in the stomach, and the margin of the

visceral wound is then united to the parietal incision by an additional row of sutures. The viscus is now washed with a mild carbolic acid solution, the growth located and scraped away with the finger-nail and sharp spoon curette. The stomach is again washed with the carbolized solution and the wound closed. Dr. Bernays in this report gives two cases treated in this way, both of which were benefited; since then he says he has had other brilliant results.

CHAPTER VIII.

INJURIES OF THE STOMACH.

Contused Wounds of the Stomach.—Contused wounds of the stomach are of rather infrequent occurrence. When sustained they are usually the result of a direct force, applied when the organ is in a state of distension. The passage of a wagon wheel over the body, the striking upon some hard substance, when falling, or a severe kick or a blow may produce the injury. If a simple contusion results the patient will complain of pain of more or less severity in the epigastric region, and nausea; soreness will follow which may last for several days. If a partial laceration results, which is ordinarily limited to the serous coating, a circumscribed peritonitis and consequent adhesions to the adjacent structures will follow. If it should be the mucous and muscular coats that are involved there will be, in addition to the above symptoms, vomiting of blood. When a complete rupture is sustained that is sufficient to allow an escape of the contents of the stomach rapid symptoms of shock will supervene, septic peritonitis will develop and death will ensue within forty-eight hours. If a doubt exists as to the true nature of the lesion a satisfactory diagnosis may be made by inflating the organ with hydrogen gas by means of a stomach tube passed down through the esophagus. If the rupture is complete the gas will be diffused through the abdomen, producing general abdominal tympanitis. If it is only partial the contour of the stomach will be outlined by the circumscribed distension.

TREATMENT. When a severe contusion or a partial rupture is sustained the patient should be put to bed and all food and drink withheld for two or three days, the thirst being relieved and the strength of the patient kept up by nutrient enemata. Substantial food should not be given for four or five days. If pain is severe, dry heat, by means of a hot-water bag, may be applied, or, if more agreeable to the patient, cloths wrung out of hot water can be used.

Arnica 1x will be the appropriate remedy. If thirst and restlessness exist it may be alternated with arsenicum 3x; if fever comes on aconite may be given instead.

When a complete rupture of the stomach has been sustained celiotomy is imperative; the abdomen must be opened at once by an incision that extends from the ziphoid cartilage to the umbilicus. The wound in the viscus must be sought and carefully brought into view, and if it has not already been evacuated by vomiting, or the escape of its contents through the rupture, the organ must be emptied and cleansed by flushing it with warm sterilized water. The extravasated inješta, when present, must also be removed by careful sponging and washing. After arresting the hemorrhage the rent is closed by two rows of sutures; the first row should be of fine silk, interrupted, sustained one-fourth of an inch apart and inclusive of the muscular and mucous coats. The second row may be

continuous (if the surgeon desires); it embraces the peritoneum and enough of the muscular coat to give a firm hold and prevent tearing out of the stitches. After the wound in the injured organ has been closed the abdominal cavity must be carefully cleansed, and if the peritoneum has been contaminated by an escape of the stomach's contents drainage should be applied and the abdomen closed. The usual precautions necessary in all abdominal operations to prevent shock, heart failure, etc., should be observed. Nourishment by means of rectal enemata must be administered for several days. When, on the fourth or fifth day, food is given by mouth it is necessary that it be of the blandest kind.

Penetrating Wounds of the Stomach.—Of this variety gunshot and stab wounds are most frequently encountered. They are usually inflicted with malicious intent, and are often of a serious nature. If the rent is large and the contents of the stomach escape into the abdominal cavity the condition should be viewed with the same gravity accorded lacerated wounds. At times when the missile is small and the viscus empty the danger is not so great; in such instances the opening may become plugged by the bulging of the mucous membrane. If food or drink be not administered for a few days the process of repair goes rapidly on, and the plastic lymph thrown out from the peritoneal side of the wound soon permanently closes it. When the stomach is distended a stab wound may only perforate one of the walls, not reaching far enough to penetrate the other; but a ball projected by a firearm usually passes entirely through both sides, making a rent of entrance and of exit; it may strike in such a way as to perforate the walls in more than two places, such cases having been recorded. When one bullet hole is found careful search must be made for another, and if a diligent inspection fails to reveal a second the organ should be inflated through the perforation already located. In fact, a wound of this character should never be closed until this test has been applied.

The passage of a bullet through the walls of the stomach or the intestine more or less impairs the vitality of the structures over an area of greater or less extent about the opening, therefore in closing such wounds the sutures that bring together the serous surfaces should be introduced well into the bounds of healthy tissue. In other respects the operation and after-treatment are conducted on the same lines as indicated in rupture of the stomach.

Gastric Fistulæ.—By the operation of gastrostomy a gastric fistula is formed, which at times it may be necessary to close. A fistula may also develop from a perforating ulcer of the stomach, or it may result from a penetrating wound. In such instances adhesions may have formed between the walls of the stomach and abdomen. These, like the former, may require surgical measures for their relief.

TREATMENT. A section of the abdominal walls down to the peritoneum should be made and the fistulous tract excised. The edges of the opening into the stomach are then freshened and the aperture closed in the line of least resistance by two rows of sutures. The first of these rows should be of fine silk, placed one-fourth of an inch apart, and should include the mucous and sub-mucous coats. The second row may be of small sheep-gut, and embraces the serous and a portion of the muscular structure. The abdominal walls are then brought together with two

lines of sutures, one buried, of sheep-gut, to coaptate the peritoneum, and one of silk to unite the overlying structures. The wound is then dusted with iodoform and plentifully covered with antiseptic gauze held in position by a bandage.

The patient must be sustained for three or four days by nourishing enemata; during this time neither drink nor food should be given by stomach.

If this measure fails, or in cases in which it is not applicable, the stomach must be entirely released from its parietal attachments, the morbid or thickened tissue excised if necessary, and the opening closed as in an ordinary gastrotomy. If a doubt exists as to the possibility of union of the gastric structures the suture line may be united to the abdominal incision in order to prevent leakage into the abdomen, drainage applied and the external wound closed. The external dressing should be of sterilized gauze and used in abundance.

Foreign Bodies in the Stomach.—Through a maniacal disposition to do unnatural things persons have swallowed objects like knives, spoons, nails, and even pieces of glass, that could not pass the pyloric orifice; at times similar objects may be accidentally swallowed. These substances, when through size and shape failing to pass out of the stomach, create more or less irritation, and it may be inflammation and ulceration, which may perforate the walls. When the object swallowed is of such a nature that its passage through the intestinal tract is probable the patient should be placed upon a diet of bread and milk, mashed potatoes, mush etc., so as to engage the body in a pliable mass of fecal matter. The administration of a purgative that produces liquid stools and increases the intestinal peristalsis is wrong in theory and in principle. When the body has taken a permanent lodgment in the gastric pouch, operative procedures are necessary for its removal. Gastrotomy should be performed and the object removed.

CHAPTER IX.

OPERATIONS ON THE STOMACH.

Lavage.—The process of washing the stomach, though seemingly trivial in its nature, is of prime importance in the treatment of some of the diseases of the organ. While in such diseases as cancer and dilatation with much thinning of the walls, it can only be classed as a palliative measure, in many of the milder disorders it is absolutely curative, and there are no other methods of treatment that can successfully take its place. The important results accomplished by the process are, first, removing the contents that accumulate in cases of dilatation, relieving the organ of both its weight and distension; second, removing from its cavity fermenting and decomposing food, mucus and fluids that irritate and inflame the mucous lining and more or less infect the system; third, the cleansing of the stomach, and the opportunity that it affords of applying direct local medication to the seat of disease. It is at times surprising to see the general improvement that follows washing of the stomach in cases of dilatation, catarrhal gastritis and other disorders that are attended with delayed digestion and consequent fermentation. If the stomach tube is used a short time before the meal is taken the food enters an empty, clean viscus, instead of one filled with sour and acrid fluid.

Of the various methods of washing the stomach the siphon process is the simplest and probably the best. A soft flexible rubber tube is used, ten to twelve mm. in diameter and sixty inches long, with one or two eyelets at the gastric end and a funnel-shaped expansion at the outer end (Fig. 574). The patient, seated on a chair or lying on a cot, is directed to elevate the chin and open the mouth. The surgeon then takes the tube from a basin of water, introduces the small end well into the pharynx, at the same time directing the patient to swallow, and, as the effort is repeated, gently pushes the tube along the esophagus into the stomach. At first much gagging and resistance will accompany the effort, but this tendency soon subsides and the operation ceases to be annoying; there are subjects, however, who cannot become accustomed to the use of the tube, persistency in its use only tending to aggravate the irritation and producing most violent spasms of the pharyngeal and adjacent muscles. Patients affected with diseases that would subject them to injury from violent retching, such as cardiac dilatation, aneurism, pulmonary hemorrhages, etc., should not be subjected to the operation.

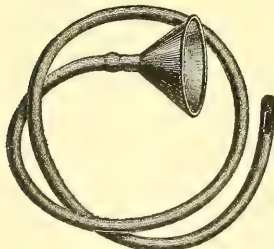


Fig. 574.
Soft Rubber Flexible
Stomach Tube.

Twenty-four to twenty-six inches of the tube should be introduced, and where great dilatation exists even more. After the tube has entered the stomach, a few ounces, ten to twelve, of tepid water may be allowed

to slowly run into the stomach, after which the contents are evacuated; when introducing the fluid, just before the funnel is emptied it is quickly depressed and the contents siphoned out. The organ should then be filled, using a pint or more, and again be evacuated; this may be repeated two or three times. To the last washing a mild, alkaline antiseptic solution may be added. There is nothing better than the formula on page 827.

Patients themselves, or some of their friends, can soon be instructed to do the operation.

Usually it will answer to wash the stomach once a day before the principal meal. In some forms of disease, where there is much tendency to fermentation, it might be proper to repeat it oftener. On general principles it should not be washed more frequently, nor the process continued longer than necessary; for like all other useful measures it has its limits.

Gastrotomy.—This term literally signifies making an incision into the stomach. The operation may become necessary for the removal of foreign bodies from the viscus or it may be required in the treatment of pyloric or esophageal strictures, gastric ulcers and for exploratory purposes.

Its history is of ancient date, it having been performed by Crotius as early as 1602, for the removal of a knife from the stomach. Other surgeons of the seventeenth century are also accredited with having done it.

Gastrotomy cannot be classed as a very dangerous operation. Gross quotes twenty cases with a mortality of but three; under modern surgical technique the death rate should be small indeed.

OPERATION. The patient should be prepared as for an ordinary laparotomy. The bowels should have been well moved the day before, and all food withheld for twelve or fourteen hours before the operation. Where it can be done without great discomfort it is very proper to irrigate the stomach before the patient goes on the table. The instruments required are a scalpel, blunt-pointed bistoury, sharp tenotome, director, thumb forceps, several pairs of hemostatic forceps, scissors (straight, angular and curved), retractors, needles (straight and curved), needle-holder, silk and sheep-gut ligatures, sponges and sponge-holders.

Chloroform is ordinarily to be preferred as an anesthetic. The patient is placed upon the left side of the table; the surgeon takes his position on the left and the chief assistant on the right of the patient.

In selecting the point of incision the condition for which the operation is done is always a governing factor in making a decision. If for the removal of a foreign body and its presence can be outlined it will suffice to open the abdomen at this point. Other circumstances might arise which would necessitate the opening being made in an oblique line parallel to and one and one-half inches to the left of the costal cartilages. Ordinarily, however, it will be found that the median incision will be the most convenient through which to conduct the manipulations. When this line has been selected as the site of operation the abdominal wall should be opened by an incision extending from near the ensiform cartilage to the umbilicus, in the same manner as in an ordinary laparotomy. When the peritoneal cavity is entered the anterior wall of the stomach is exposed, drawn forward and two sutures passed through

the serous and muscular coats, one on either side of the line through which the opening is to be made. The anterior wall is then drawn well forward and steadied while sterilized gauze or flat sponges are placed around the parietal opening to prevent the possibility of leakage into the abdominal cavity. The wall of the stomach is then punctured with a sharp-pointed tenotome and incised in a line transverse to the long axis of the viscera and in line with the abdominal wound. The opening should be sufficiently large to easily execute the removal of the foreign body and to dexterously perform the manipulations. When the entrance into the stomach has been effected the forefinger should be inserted, the viscus explored and the foreign body accurately located and carefully extracted, either with the finger or forceps. Gentleness must govern the manipulations, lest the organ be injured or perforated. After the foreign body has been extracted the stomach may be washed out, if necessary, and the opening in its walls closed. This is done by two rows of sutures; the first, of fine silk, includes the muscular and mucous coats, the second may be of small-sized sheep-gut and embraces the serous and muscular layers; for this layer either the continuous or Lembert suture may be employed. The wound in the stomach having been carefully closed, the parts are cleansed, the gauze packing removed and the parietal walls brought together in the usual way.

After the patient is put to bed he must be kept quiet, and perfect rest be given the stomach for four or five days, alimentation being carried on by means of rectal enemata. The first nourishment given by mouth may be peptonized milk diluted with equal parts of water; after two or three days more bland but nourishing food may be given in small quantities at short intervals. If vomiting comes on at any time all food and drink must be withheld until it ceases.

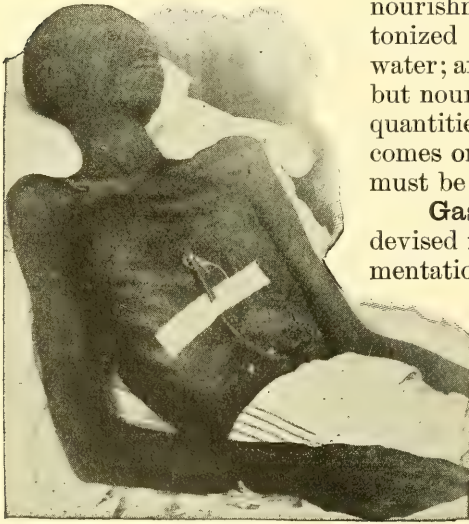


Fig. 575.
Showing Tube in Stomach.

Gastrostomy.—This operation was devised for the purpose of conducting alimentation through an artificial opening made into the stomach through the abdominal parietes. The method was first advocated by Egebert, a Norwegian surgeon, in 1837. Sedillot, in 1849, was the first to execute the operation. His patient died. Many other surgeons of prominence attempted the operation, but like unfavorable results followed their efforts. It was not until

1874 that a satisfactory result was obtained, when Sidney Jones successfully performed it.

The operation is called for in cases of malignant or cicatricial stenosis of the esophagus or cardiac opening of the stomach, when the closure has advanced to that extent that it is no longer possible for the patient to take sufficient nourishment through the natural channel to

sustain his strength. When the operation is done for the relief of the distressing symptoms incident to malignant diseases it is usually exceedingly disappointing. This is largely owing to the fact that the trouble is progressive in its nature. The operation is seldom performed until other organs are deeply involved and an extreme degree of emaciation exists. Since the operative measure in cancerous cases has solely for its object, through artificial feeding by way of a gastric fistula, the sustenance of the patient and the relief of the distressing symptoms consequent to starvation, if satisfactory results are to be expected it must be done early, before a dangerous state of marasmus has been reached. The same advice holds good where the treatment is instituted for cicatricial stenosis. In order that the stomach digestion may be interfered with as little as possible it is necessary that the opening be made as near to the cardiac entrance of the stomach as possible.

To one who has experienced the disappointments of gastrostomy, even in cicatricial stricture of the esophagus, any increased light comes with welcome and gratitude. The method of Fenger, which has sustained professional endorsement for half a century, is primitive and wanting. The tube which at first fits snugly and seems to act nicely in conducting fluids into the gastric pouch soon—within two or three days—becomes loose and allows the food to regurgitate and flow out of the viscus, and emaciation advances in almost the same degree that it did before the opening was made. Again, the gastric juice that constantly oozes at times runs through the fistula, producing a troublesome and painful eczema that distresses and tortures the patient no little. Every measure that ingenuity could devise has been tried to overcome this objection but without satisfactory results.

Owing to its antiquity a work on surgery would hardly be complete without a description of the method of Fenger, though it is in reality from a modern stand-point unworthy of mention.

FENGER'S METHOD. When the patient's strength will permit, the operation should be in two stages, as by this method leakage into the abdominal cavity is less liable to occur, therefore, it is safer; further, it is important to make the incisions into the stomach as near the cardiac orifice as possible. The same preparation should be observed as recommended in gastrotomy. An incision two or three inches long is begun near the median line and carried obliquely downward, parallel to and one inch internally to the costal cartilage (Fig. 576 A). Its center should rest one inch below the margin of the liver, which in a thin subject is easily outlined. The abdominal wall is divided with a very sharp scalpel down to the peritoneum. After all bleeding has stopped the peritoneum is niched between forceps and incised up to either angle of the abdominal wound, then the parietal peritoneum is stitched to the skin with fine sheep-gut. Retractors are now introduced and the stomach sought; if it is of natural size it comes readily into view, but if contracted it will be found lying well beneath the under

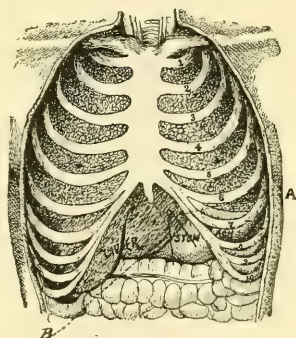


Fig. 576.
A. Fenger's Incision.
B. Von Hacker's Incision.

surface, of the left lobe of the liver. It is recognized by its smoothness of surface, opacity, faint pink color and stiffness of its walls. The inspection must be made with coolness and care, as the colon has been mistaken and opened instead. After the stomach has been found it should be drawn down and caught with T forceps near the cardiac extremity in such a way that no traction is made upon it; a cone-like portion of it is drawn forward into the abdominal wound and carefully and accurately sutured to it by two rows of sheep-gut sutures, one deep and one superficial, the sutures being made to take a good hold of both the serous and muscular coats. The section of the stomach exposed ought not to be larger than a nickel. After these stitches have been taken if the exigency of the case demands it the opening may be made in the stomach forthwith, but if postponement of direct feeding is possible the wound and exposed area should be dusted with iodoform and dressed with sterilized gauze. At the expiration of the third day, or sooner if necessary, the dressings are removed and the surfaces cleansed of the iodoform coating, after which a sharp tenaculum is engaged in the stomach wall by which it is steadied, while a slender tenotome is made to penetrate its walls, and a very small incision made that will only allow of the introduction of a rubber tube the size of a number eight English catheter. It is important that the tube be snugly engaged in the opening. The wound is then again dusted and packed with gauze. A small funnel is then attached to the tube and two or three ounces of milk, or milk and barley with a spoonful of brandy, are introduced into the stomach. The feeding may be repeated in this way every two or three hours, varying the quantity until the gastric fistula is established, when the patient may be allowed to masticate his food and place it in the stomach through the fistula. The tube must be cleansed repeatedly and changed for a larger one when necessary. After feeding it may be secured to the body by means of a plaster and the end then closed by a clamp. The diet should consist of milk, cream, white of egg, beef tea, chicken broth, soups, cocoa, etc. Water in sufficient quantity is required at stated intervals.

The wound should be frequently cleansed and smeared with vaseline, after which it is plentifully dusted with bicarbonate of soda, to neutralize the acidity of the gastric juice and thereby diminish the tendency to eczema. Absorbent pads should be kept constantly applied and frequently changed.

Of the modern methods those of Von Hacker, Witzel and Ssabanejew-Frank are to be commended. The latter is probably the simplest and has been demonstrated to be quite satisfactory. It has a serious drawback, however, in the fact that the resulting fistula is difficult to close, therefore the operation is suitable only in cases of malignant stricture where it may be necessary to maintain the patency of the opening during the remainder of the patient's life. To one skilled in abdominal methods and dexterous in visceral suturing Witzel's method is an ideal one, and when successful gives the most perfect results. It prevents leakage perfectly, permits the removal of the tube and its reapplication at every feeding and possesses a superior advantage on account of the certainty of closing the tract when the tube has been permanently removed. The operation, however, is contra-indicated in those cases where the stomach is greatly contracted and will not permit of sufficient

infolding of its walls, and, since the procedure is necessarily a protracted one, in patients who are greatly reduced in strength. When these objections obtain the preference should be given to Von Hacker's method, for in this, as in the former, the fistula can be closed. Considering the superior advantages offered by the modern method of gastrostomy the importance of an early resort to operation, before the patient becomes greatly reduced and emaciated either from pain or hunger, cannot be too strongly presented.

VON HACKER'S METHOD. Beginning one inch below the border of the left ribs, and also one inch to the left of the median line, a vertical incision three inches long is carried down to the rectus abdominis muscle, (Fig. 576 B). The muscular tissue is then separated with the handle of the scalpel and the peritoneum opened. The anterior wall of the stomach is secured as near to the fundus as possible, pulled forward into the wound, and two silk ligatures embracing the serous and muscular coats are introduced and given to an assistant. These should run parallel to the longitudinal axis of the organ, and are to be left as guides in making the final opening. Next a silk-worm gut suture is entered near the upper border of the parietal wound and passed through the entire thickness of the abdominal wall, catching on its way a firm hold in the stomach, re-entered beneath on the opposite side and brought out through the skin. Another is passed in like manner at the lower angle and both secured by catch-forceps. The stomach is now secured to the abdominal incision by four or five stitches on either side. The silk-worm gut sutures are then tightened and tied, the angles of the abdominal opening closed, and the wound dusted with iodoform and dressed with gauze.

Two or three days later the stomach is opened as in the Fenger method. The fibres of the rectus abdominis muscle form a kind of sphincteral guard over the fistulous outlet which prevents the regurgitation of food. At first the opening in the stomach enlarges and an increase in the size of the tube is demanded, but later cicatrization ensues and the tube will be quite firmly held in place. The after-treatment is also conducted as in the Fenger operation.

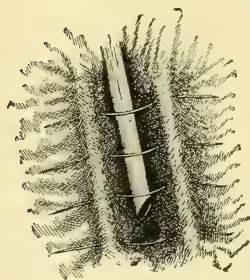


Fig. 577.
Showing method of introducing the Tube into the Opening in the Stomach Wall.

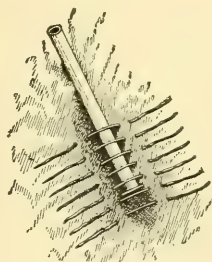


Fig. 578.
Showing Lembert's Sutures introduced Preparatory to Infolding the Walls of the Stomach.

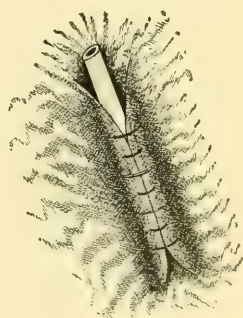


Fig. 579.
Showing Closure of the Stomach Walls over the Tube.

WITZEL'S METHOD. The abdominal opening is made the same as in Fenger's operation. The edges of the wound are drawn wide apart with broad retractors, the stomach is drawn out into the wound and the mar-

gins well packed with gauze, a small opening is then made into its walls near the cardiac extremity and a tube No. 30, F. scale, snugly introduced, Fig. 577. A double row of Lembert sutures are next introduced to the extent of one and one half inches, so as to infold the wall of the stomach and bury the tube, Figs. 578 and 579. These folds run parallel to the external wound. The infolded area is then stitched to the edges of the external wound, thus rendering the field of operation extra-peritoneal. The hooks which hold the muscles apart are removed and the abdominal wound sutured with silk-worm gut up to the point where the tube escapes. The patient may be fed through the tube immediately.

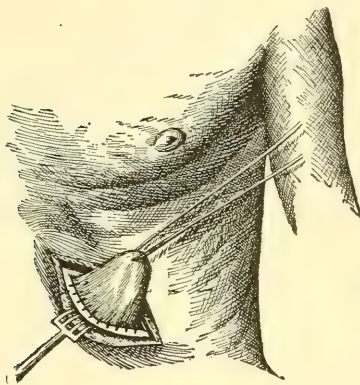


Fig. 580.
Showing Anterior Wall of Stomach
Drawn out into the Parietal Incision.

SSABANEJEV-FRANK'S METHOD. The primary incision is the same as in Fenger's, only nearer the costal cartilage. The stomach is drawn forward into and through the wound in a cone-like prominence to the extent of about one inch or more and is held in position by the inserting of a silk loop in its apex, Fig. 580.

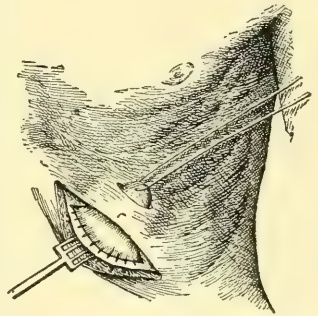


Fig. 581.
Showing Apex of Cone Emerg-
ing through Second Skin In-
cision.

The edge of the peritoneal opening is now united to the base of the cone, same figure, closing the peritoneum; this union may be strengthened by an additional row of sutures to include the muscular structures of the parietal walls. A second incision, one inch long, is now made above the border of the ribs and one inch from the first, including the skin only. The bridge of skin interposing between the two incisions is now separated from the tissue beneath, and the cone pulled up underneath it, Fig. 581, after which the lower abdominal wound is closed. The apex of the cone is incised and the edges of the stomach wall united all round to the skin, Fig. 582.

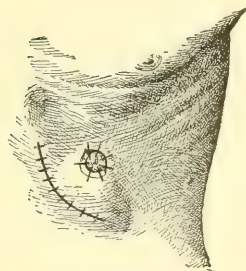


Fig. 582.
Showing Wound
Closed and Apex of
Cone Stretched to the
Skin Wound.

This operation is reported upon most favorably. It gives a long and oblique canal, and closes perfectly tight without special apparatus. A catheter is used for feeding.

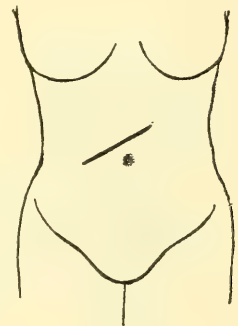


Fig. 583.
Billroth's Oblique
Abdominal Incision
for Operation upon the
Stomach.

Pyloroplasty.—When

stenosis of the pyloric orifice exists and is not amenable to dilatation other methods must be instituted for its relief. Heineke devised the operation known as pyloroplasty; soon after Mickulicz performed the same

operation in about the same way for the correction of the trouble. He was not aware that another had forestalled him in this procedure.

The patient is prepared the same as for other operations on the stomach. The abdomen may be opened either by a vertical or an oblique transverse incision (Fig. 583). The latter is known as Billroth's, and

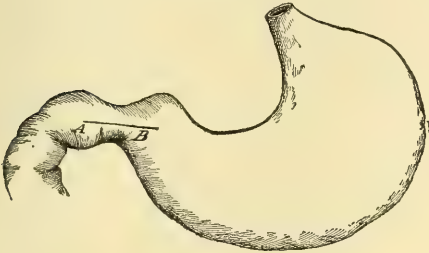


Fig. 584.

Pyloroplasty—A-B, Line showing Longitudinal Incision through the Anterior Wall of the Pylorus.

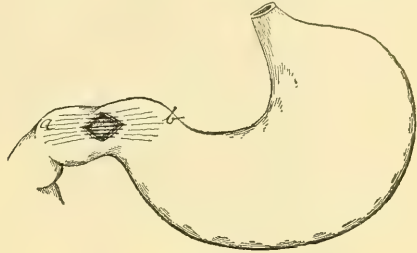


Fig. 585.

Pyloroplasty, Indicating the Method of Suturing and the Manner in which the Points a-b are Approximated.

gives more room in which to conduct the manipulations, but it is more difficult to close than the other, and leaves a greater tendency to the production of hernia. After the parietal incision has been made the pyloric extremity is located and brought well into the wound, the usual care to prevent leakage into the abdomen being observed. The contraction is then divided through the anterior wall by a straight incision that runs parallel to the long axis of the stomach, (Fig. 584). It should be about one and one-half inches in length, extending on either side of the stricture,

as shown in the line A B. The viscus is then washed out and the opening closed by two rows of sutures, as in gastrotomy. These are introduced longitudinally, and when tightened the points A B are approximated, as shown in Figs. 585, 586, the stitches at the angle of the wound being first tied.

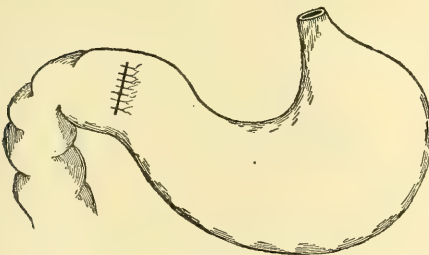


Fig. 586.

Pyloroplasty Showing the Wound Closed in a Transverse direction, also the Increased Capacity of the Pyloric Opening.

of the stricture is seemingly beyond the bounds of possibility.

Pylorectomy.—Resection of the pylorus consists in removing the pylorus with the adjacent diseased structure, which may include both a portion of the stomach and duodenum. The operation was first successfully done by Billroth; however, Pean did it in 1879, and Rydygier in 1880, though both had fatal results.

PREPARATION. For three or four days before the operation, in order to give the stomach rest, the diet should be restricted to the blandest kind of nourishment; if the patient is weak and feeble the feeding may be reinforced by nutrient rectal enemata. Beef extracts, peptonized milk, light custards and other easily digested substances may be given. For a week the stomach should be daily irrigated with a mild antiseptic

The after-treatment is the same as in other operations on the stomach. The results following this procedure are quite satisfactory; a recurrence

solution, (see page 827), the last washing being done one or two hours before the operation. The same preparation of the patient is required as in an ordinary laparotomy. Chloroform should usually be given the preference as an anesthetic.

In opening the abdomen Billroth's oblique parietal incision is preferable, and it should be not less than five inches in length, that

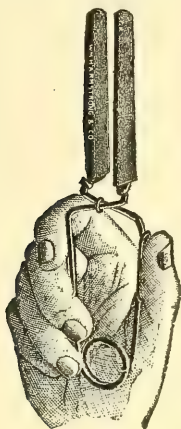


Fig. 587.
Willbrand's Intes-
tinal Clamp.

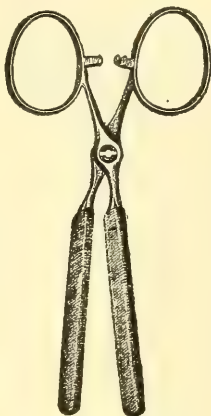


Fig. 588.
Wathen's Intestinal
Clamp.

ample room may be obtained through which to conduct the manipulations. The pylorus is sought, the diseased structures drawn well into the parietal opening and the wound packed with sponges or gauze, in order to protect the peritoneal cavity against infection. The omentum below the pylorus is tied in sections with fine sheep-gut or silk, and divided between ligatures. The lesser omentum is released in the same manner; such adhesions as may exist are broken up, and any enlarged glands that may be present removed. The pylorus, having been secured, is drawn well forward and a large sponge passed beneath it, after which the duodenum is clasped by a flat clamp, (Fig. 587). The stomach is now divided with strong scissors from above downward, at least one inch from the diseased area, (Fig. 589). The cut surfaces of the stomach being much in excess of that of the duodenum, the stitching must be begun before the section is complete, and carried down to a point that will correspond to the size of the duodenum, (Fig. 590); these sutures, for the time, are left long, in order to steady or support the organ. It is important, moreover, that the duodenum should be fixed to the greater curvature.

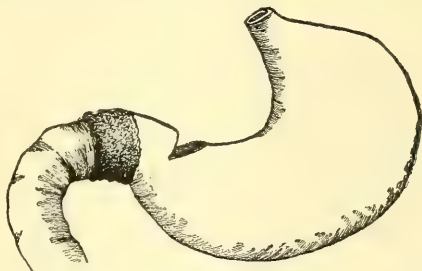


Fig. 589.
Pylorectomy—First Incision.

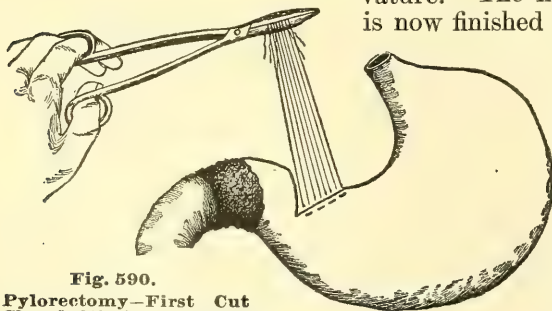


Fig. 590.
Pylorectomy—First Cut
Closed; Stitches Left Long.

The incision of the stomach walls is now finished and the duodenum excised well away from the diseased border, after which all bleeding vessels are secured and the stomach irrigated. The excision having been completed, the posterior borders of the two openings are brought in contact and a union effected by two rows of sutures; the first, a continuous suture, includes the muscular and serous coats, bringing together

a considerable strip of serous membrane, (Fig. 591). The mucous coat is then united by a row of fine silk. The order of suturing is now reversed; viz., the mucous line of sutures introduced first and then the serous, and the anterior walls united. Any weak points in the line of suturing may be reinforced by additional sutures. Billroth in some cases sutured the incision in the stomach completely and attached the duodenum to an opening made in the anterior wall of the stomach. Various modifications in both the incisions and modes of suturing may be demanded, according to the exigencies of the case. When making a resection, complicated methods of suturing should never be adopted, as valuable time may be consumed in this way. After the suturing of the stomach has been completed the edges of the omentum are united to the altered stomach, after which the field of operation is carefully cleansed and the abdomen closed in the usual way. (Fig. 592). The after-treatment must be conducted on the same general lines as recommended in gastrotomy. The results of the operation are not flattering, the percentage of death rate being large and the recurrence of disease after the operation universal so far.

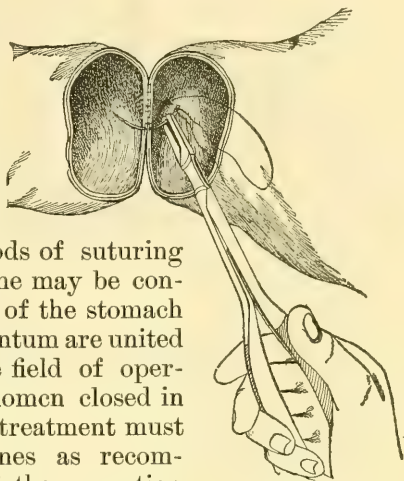


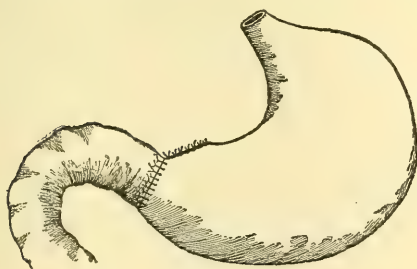
Fig. 591.
Pylorotomy—First Row of Sutures in Posterior Wall Bringing Together the Serous Surfaces.

Gastro-Enterostomy.—This operation consists in establishing a new outlet from the stomach into the intestinal tract. In malignant pyloric stenosis it is to be preferred to any of the other operative methods of dealing with the trouble, and in cicatricial stricture at this orifice it may at times be given preference over pyloroplasty in those cases in which that method is inappropriate.

Wolfier, of Vienna, first performed the operation in 1881; late the same year Billroth and Lauenstein also performed it. The mortality is quite large, amounting to 57.2 per cent.

The preparation of the patient is the same as for any of the other important operations on the stomach.

Fig. 592.
Pylorotomy—Duodenum United to Greater Curvature and the Wound in Stomach Closed Throughout.



The abdomen is opened by the oblique transverse incision (Fig. 583) and the stomach exposed. A loop of the bowel is now caught and brought forward into the wound; it is gently drawn out and inspected until a point from thirty to forty inches from the pylorus is reached. In passing the bowel through the fingers for examination it must be remembered that as the duodenum is approached the walls become thicker, and the tint of the peritoneal coating grows lighter, while if receding from this part the bowel grows smaller the walls thinner and the color brighter. When the point is reached at which it is designed to make an opening the bowel is

turned half upon its axis to the right, (Fig. 593). which brings the peristaltic wave of the intestine in the same direction as that of the stomach; this modification of Rockwitz, is of material importance, since it

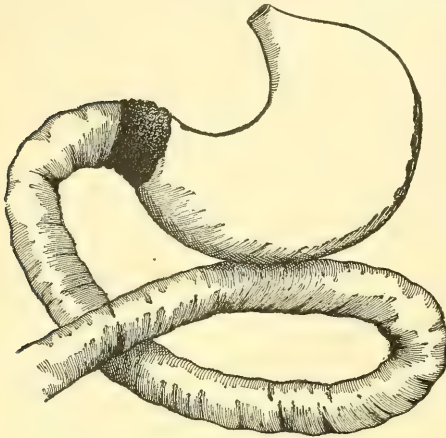


Fig. 593.

**Gastro-Enterostomy, Rockwitz' Method of
Establishing an Anastomotic Opening
between the Stomach and
Small Intestine.**

expedites the passage of the contents of the stomach into the intestinal tract. The bowel and the anterior wall of the stomach are drawn well into the abdominal wound and packed about with warm sponges or gauze. Two clamps are then placed upon the duodenum four or five inches apart, after which it is opened upon its convex surface by a three inch incision and its cavity between these clamps thoroughly irrigated. The stomach is opened by a similar incision and its cavity also washed out. The inside surfaces are now laid together and the posterior edges united, just as in gastrotomy; viz., the sutures bringing together the serous coats are

first applied, and then those that coaptate the mucous coats; the order is reversed in uniting the anterior walls. The union between the stomach and intestinal walls may be accomplished by means of Senn's decalcified bone plates, or the Murphy button, as in intestinal anastomosis.

The abdomen is closed as in other operations upon the stomach, and the after-treatment is also conducted in the same way.

CHAPTER X. APPENDICITIS.

Anatomy.—The cecum bears an important relation to the appendix vermiformis, and is a governing factor in its location. It is the closed head of the colon, and is in its anatomical structure identical with it. It is situated in the right inguinal region and enveloped by the peritoneum, which is reflected to the posterior wall of the abdomen, holding it in position. A portion of the posterior wall of the cecum is in relation with the iliac fascia through connective tissue. A suppurative process is sometimes developed here, and a sub-peritoneal abscess results. The cecum usually rests upon the psoas muscle, its apex projecting just beyond the inner border of that muscle, corresponding to a point a little to the inner side of Poupart's ligament. It may, however, vary from this position, and is sometimes found external to the iliacus in the iliac fossa; again, it may be found to the inner side of these muscles, either resting on the pelvic brim or entirely within the pelvic cavity. Instances have been recorded where the cecum was situated to the left of the median line. In cases of non-descent its location is correspondingly changed. The variations in the position of the cecum have been attributed to its mode of development. Owing to its loose connection to the abdominal wall it is freely movable.

Appendix Vermiformis.—The appendix is the rudiment of the lengthened cecum, and has its attachment to the cecum immediately behind the entrance of the small intestine. It varies in length from three to six inches or more, and its diameter is usually about five-sixteenths of an inch. It is slightly curved upon itself, the distal extremity pointing to the left and outward or upward, or it may be entirely within the pelvic cavity; the walls are thick and the mucous membrane is supplied with solitary glands. Its canal is small and communicates with the cecum, being guarded by an imperfectly formed valve. The organ is held in position by a special fold of the peritoneum, and, like the cecum, is susceptible of great mobility.

The blood supply of the appendix is derived from the ilio-cecal artery, the lowest branch given off from the concavity of the superior mesenteric. It descends between the layers of the mesentery to the right iliac fossa, where it divides into two branches; the inferior or iliac branch anastomoses with the lowest branches of the vasa intestini tenuis, from the convexity of which branches proceed to supply the termination of the ilium, cecum and appendix. The appendicular branch passes along the free edge of the mesentery, or, in case the mesentery is absent the artery runs beneath the peritoneal coat of the appendix. In the male this organ is usually nourished by this single artery, but in women the appendiculo-ovarian ligament supplies it with a small arterial branch.

The nerve supply of the appendix is derived from the superior mesenteric plexus.

Etiology.—Heretofore the etiological ideas of appendicitis have been based upon theory and supposition. The presence of a foreign body of some kind within the appendicular canal was supposed to be the most frequent, if not the sole, cause of a suppurative condition of the appendix and its adjacent structures. While it is quite true that such substances as grape seed, small shot, cherry stones, small fragments of bone, etc., have occasionally been found to be the exciting cause of inflammation and suppuration of the organ, it is, in fact, the rarest exception. Fecal matter, either in a soft or hardened state, is present in a greater number of cases than all other substances combined. In one hundred and twenty-four cases reported by Bryant it was present in sixty-seven per cent. of them, seventy per cent. being males and fifty-six per cent. females. In not a single instance was a foreign body, such as grape or other seed, found. Matterstock gives a list of one hundred and sixty-nine fatal cases of perforating appendicitis in which fecal concretions were present in fifty-three per cent. and foreign bodies in twelve per cent. Fowler, in an exceptionally large experience in operative treatment of appendicitis, reports that in but two instances did he find a foreign body, and that one of these was a true enterolith. In the experience of the author in a majority of cases some form of a body has been found, which in every instance was likened by the assistants to a date seed, cherry-pit, etc., but a careful inspection always revealed the real nature, proving it to be a mass of fecal matter. Therefore, the conclusion is that the presence of fecal accumulation is responsible for a large per cent. of cases of appendicitis.

It has been stated as a physiological fact that the tissue of the appendix is possessed of considerable power of absorption; that the liquid fecal matter which accumulates in the canal loses its watery consistency by absorption, leaving the residual matter deposited about a nucleus, layer upon layer, thus forming laminated concretions, which excite various degrees of irritation, resulting in erosions or ulcerations with all their disastrous consequences.

Traumatism is undoubtedly a minor causative factor in the development of the disease. In one case operated upon by the author the trouble dated from an injury received a few days before the attack. Indigestion is also regarded as a determining cause. The disease is often due to circulatory disturbances and nutritive changes, resulting from either nervous or vascular causes.

Appendicitis occurs more frequently in the male than in the female. In the list reported by Bryant, in the proportion of eighty-six to forty-four; while Fowler states that the disease prevails in the two sexes in about an equal proportion. Of a total number of 643 cases reported by Bamberger, Volz, Marchal, Paulier, Fitz and Maurin eighty per cent. occurred in males and twenty per cent. in females.

The disease is rare in either infancy or old age, the most prolific period for its development being between the ages of ten and thirty years.

Pathology.—During the past few years the extensive researches that have been made in pathology have greatly changed the professional thought in regard to some of the obscure diseases of the abdominal cavity. A condition that was formerly known under the vague title of typhlitis, perityphlitis, extra-peritoneal abscess of the right iliac fossa, etc.,

indifferently described in the text-books, is now acknowledged to be varied stages of appendicitis, or results that follow its disorganizing influences. There has developed a consensus of opinion upon the subject, and all pathologists agree that the diseases which occur about the ilio-cecal valve usually have their origin in the appendix.

Whatever the etiological factor that excites appendicular disturbances may be bacterial infection is responsible for the inflammation, exudation and suppuration that follow. The mucosa of the appendix is composed of a single layer of columnar epithelium. Beneath this delicate lining is a thick layer of adenoid tissue, which constitutes the principal mass of the appendix. Any injury to this epithelial coat, whether it be from traumatism, a foreign body, fecal concrement, trophic nervous disturbances, nutritive changes from any cause, or a catarrhal extension from adjacent intestinal viscera, gives lodgment to micro-organisms, and disintegration of the histological elements is set up; exudations into the adenoid tissue follow, and consequent vascular stagnation results. The bacillus coli communis predominates in the inflammatory exudates as an infectious agent; additional micro-organisms, as the streptococcus, staphylococcus and others, are also demonstrable.

When the mucosa has once been invested by septic germs the subsequent development of a disintegrating course varies greatly. The virulence of the infection and the circulatory changes are prominent etiological factors in the process. Where gross lesions do not exist the course of inflammation may be characterized by gradual erosions and ulceration of the epithelial covering and the subjacent adenoid structures, the process of disease being accelerated or retarded according to the degree of infiltration accompanying it; when the exudation is excessive a rapid course ensues. The lodgment of a foreign body and the presence of an enterolith in the canal, the formation of a thrombus in the terminal artery, and torsion of the appendix are causes that lead to the most rapidly destructive terminations.

Peritoneal infection may be direct, and either local or general peritonitis, or abscess of the sub-peritoneal tissue may result; again, the disease-bearing germs may be transmitted through the lymphatics, developing perityphlitis and kindred troubles; or the extension may be along the veins, infecting alike distant organs and structures.

The pathological developments that accompany an attack of appendicitis are much the same as those that characterize other intra-abdominal inflammatory diseases. The initial manifestation after infection has taken place consists of hyperemia, or congestion of the parts, attended with more or less of exudation. During this stage, if the exciting cause is removed, the inflammation may subside by resolution, or if the cause is only partially removed the condition may terminate in a chronic state, with tendencies to relapse—recurrent appendicitis; again, when the irritation persists suppuration will follow; or if the circulatory disturbances are grave rapid sloughing, or gangrene, may ensue, the exudations being overwhelming, the circulatory disturbances profound, a rapid breaking down of tissue, before inflammatory adhesions have formed, following—fetid pus, the product of bacterial infection, and the intestinal contents being emptied into the peritoneal cavity, causing severe shock, rapid septic peritonitis, and a promptly fatal termination.

Diagnosis.—Advanced cases of appendicitis offer but little difficulty to a correct diagnosis. The symptoms are severe and generally well defined. The physician is aroused and on the alert, recognizing that he has a serious trouble with which to deal. The position of the patient, the anxious countenance, cold, clammy perspiration, quick pulse, rapid and irregular respiration, tympanitic and sensitive abdomen, cause him to look carefully into the case. These advanced cases, however, unless by a scratch, die under any form of treatment. Only those patients who are operated upon early give successful results; therefore, it is important that a correct diagnosis should be made in the beginning of the malady; and yet in the early stages of the disease the symptoms are usually vague. The patient will often complain of a general abdominal pain, or he will refer the pain to the epigastrium; in fact, such a state of indefiniteness may exist that unless the physician is awake to his duty he is liable to treat the matter as trivial, lull the patient with an opiate, and trifle away valuable time that consigns the latter to his grave. Since an early diagnosis of appendicitis bears such an important relation to a successful management of the disease, and since the initial manifestations are often delusive, it becomes imperative that in every case of abdominal trouble that is not clearly definable the physician should make a most careful exploration of all the abdominal viscera. Pain is a primary factor in the symptomatology in the majority of cases of appendicitis. Its advent is usually sudden and of a sharp, colicky nature. In the beginning it is ordinarily referred to the umbilical or epigastric regions, seldom to the appendicular area. As the disease advances and local peritonitis develops the pain fastens itself more or less in the right iliac fossa. It is a known fact that in the early stages of hernia, intestinal obstruction and kindred ailments the pain is also referred to the region of the umbilicus and epigastrium. This is probably owing to the fact that the intestinal nerve supply is derived from the superior mesenteric plexus (a continuation of the solar plexus), which is distributed to both the large and small intestines. When the pain is localized in the region of the appendix it is an indication that a local peritonitis has started up. The local pain is incident to the peritonitis. Concomitant with the pain, or soon after it begins, nausea and vomiting may come on, also reflex symptoms. In the initial stage vomiting is not persistent, and consists of the matter contained within the stomach. It may return later, when peritonitis supervenes or perforation has taken place, when it is more or less constant and is of a watery, greenish, acrid and disagreeable character.

Constipation may exist as a primary factor in the beginning of the disease, indicating a rapid development of paresis in the intestinal walls, or it may occur as a late symptom, the usual attendant of septic peritonitis.

A considerable number of cases are preceded or accompanied by diarrhea of more or less severity. In cases where laxity of the bowels precedes the attack it is probable that a catarrhal lesion of the cecum exists and the appendicitis is a secondary development. In most instances, however, it is the result of septic peritonitis. Tenderness is manifest in every case; while it may be more or less diffused over the abdomen, especially if any degree of peritonitis is present, it will usually reveal its point of maximum intensity in the right iliac fossa, over the

site of the appendix; this, known as McBurney's point, is generally at the outer edge of the right rectus abdominis muscle, at a greater or less distance below a line extending from the umbilicus to the anterior superior iliac process (the omphalo-spinous line). Tenderness in the early stages is not so prominent as it is later; this may also be true of both dullness on percussion and resistance to pressure, but as the disease advances a distinct tumor may develop, which, owing to the edematous condition, emits a doughy sensation to touch. A reflex rigidity of the rectus muscle, a guard as it were to the sensitive spot, usually exists, and if the leg is extended the tension put upon the muscle produces pain in the affected region. It must not be forgotten when palpating for tenderness that abnormalities in the location of the appendix sometimes occur, and that symptoms resulting from such unnatural distributions may also be present. Cases are on record where the appendix was located beneath the left rectus muscle.

While pain is always a prominent factor, and is usually severe, the constitutional symptoms vary greatly. The temperature in the early stages is usually moderate, ranging from 99.6 degrees to 100 degrees Fahr., but as the disease advances, and where a high degree of sepsis exists, it sometimes reaches 105 degrees. A remission of the temperature may take place without amelioration of the condition; even a perforation and discharge of pus into the abdominal cavity may occur under a decreasing temperature. Where perforation takes place the advent of septic peritonitis is announced by its usual train of symptoms, viz.: increased pain and tympanitis, change in the character of the temperature, which may drop quickly, weak pulse, rapid and irregular respiration, cold, clammy perspiration, and anxious countenance. When inflammatory adhesions have been thrown out and the appendix is walled in, as it were, the exudations being extra-peritoneal, a decidedly different train of symptoms may exist, such as generally attend a case of septicemia. The temperature assumes a decidedly remittent type, and the pain takes on periods of exacerbation as the area of inflammation increases. The skin is more natural in both feel and appearance; the cold, clammy perspiration if present is less profuse; the pulse, though quick and weak, is not arrhythmical; the respiration is not quickened, irregular and oppressed, and the facial expression does not possess the characteristic peculiarities of the former condition.

Summary.—The advent of the disease is sudden. The pain, acute and severe, is first felt in the epigastric and umbilical regions; later, within a few hours, it is centered in the right iliac fossa. The vomiting comes on early; in the beginning it consists of the natural contents of the stomach, more or less altered by digestion, but as the disease advances it changes to greenish, frothy, acrid, offensive matter, sometimes becoming stercoraceous. Constipation is usually present in the beginning, and is attended with more or less tympanitis, though diarrhea may either precede or follow the attack. Palpation reveals tenderness in the right inguinal region at McBurney's point; this symptom, when pronounced, is highly indicative; the increase or subsidence of the tenderness bears a close relation to the advance or retrogression of the disease. After inflammatory exudations have taken place a perceptible intumescence can be outlined in the region of the appendix, which has a

doughy, soggy feel. The patient lies upon his back, frequently with the right thigh flexed and the rectus abdominis muscle tense. The temperature in the beginning is moderate, ranging from 99.6 degrees to 101 degrees, pulse 90 to 100, regular, strong and full. When purulency is established the pyrexia runs higher; it may reach 105 degrees or more, and become exacerbating; the pain grows more and more severe, and the area of tenderness increases as the inflammation extends. A tumor develops over the cecum, and a marked degree of tympanitis is present.

When perforation occurs, with consequent septic peritonitis, the abdomen rapidly becomes greatly distended; the temperature, which at first increases, recedes and may become sub-normal. The pulse grows quick and weak, the respiration irregular and oppressed, the features pinched, the skin purplish, cold and clammy.

The disease must be differentiated from acute indigestion, severe colic, intestinal obstruction and invagination, hepatic and nephritic colic and hernia; in addition, in the female, to pyosalpinx, extra-uterine pregnancy and pelvic hematocele.

Prognosis.—Of the various acute maladies that affect the abdominal structures appendicitis is probably the most important. It is estimated that this disease is responsible for a greater number of deaths than any other acute intra-abdominal lesion. Owing to the fact that incorrect diagnosis is so frequently made in the treatment of disorders of this region it is quite difficult to properly estimate the mortality in appendicitis. In a large percentage of those patients who die from obscure diseases, usually diagnosed as acute indigestion, bilious colic, inflammation and congestion of the bowels, idiopathic peritonitis, etc., the cause should be accredited to appendicitis. Many factors enter into the problem of prognosis, viz.: the severity of infection, the extent and rapidity of invasion, and the delay in operating.

In mild cases where the advance of the disease is checked within a few hours, and thus becomes retrogressive, the prognosis without operation may be considered favorable. In all other cases the prognosis bears a relative proportion to the delay in operating. In no other disease is prompt interference on the part of the surgeon so imperative. It usually means life or death to the patient. The prognosis in operative cases depends largely upon the pathological condition that exists, the injury sustained at the time of operating, and the knowledge, skill and experience of the surgeon. The prospect of recovery in simple catarrhal appendicitis is good, where perforation of the walls has not taken place; and the same may be said of recurrent cases, or when localized peritonitis exists. When an appendicular abscess has formed and it can be opened and drained without invading the general peritoneal cavity the prospect of recovery is also good.

In delayed cases, and in the fulminating variety, where a general septic peritonitis exists, when the intestines are paralyzed by the septic poison, the results are almost invariably fatal.

Treatment.—Appendicitis is now regarded as a surgical disease, and it has been satisfactorily demonstrated that its treatment by surgical methods yields far better results than were ever obtained by therapeutical management. It is quite true that every physician of experience has seen cases recover under the expectant and remedial plan of

treatment, but such patients can never be regarded as safe; for the liability to a recurrence of the attack, with serious termination, is probable.

A well executed exploratory abdominal section is less dangerous than any attack of appendicitis, no matter how mild it may seem. When the physician is called early, before a positive diagnosis can be made—and even in doubtful cases an exploratory laparotomy is the safest plan—the patient may be placed upon medical treatment, but as soon as the diagnosis of appendicitis is confirmed a section should be made and the appendix removed.

The patient should be placed quietly in bed, and if the bowels are constipated a mild saline purgative should be administered. Under no circumstances should morphine be given, as it lulls the patient and masks the disease. Dry heat may be applied through the medium of a water-bag, salt sack, or plate. Only the blandest of nourishment should be administered, and the thirst should be allayed by sipping hot water, small draughts of soda or Apollinaris water, or by using, in small quantities, crushed ice. A careful selection of remedies should be made and assiduously administered.

Aconite. High fever, skin hot and dry, restlessness and great thirst.

Arsenicum. Restlessness, thirst for small quantities, nausea and vomiting, great prostration, diarrhea, stools watery, greenish and slimy.

Belladonna. High fever, flushed face, dilated pupils, moist skin, great pain in the ilio-cecal region, cannot bear the slightest touch.

Colocynthis. Cutting, pinching, contracting pains, nausea and vomiting, diarrhea with colicky pains, causing patient to draw up the limbs and press the abdomen.

Dioscorea. Remitting, griping pain in the epigastric and umbilical regions, with constant desire to evacuate the bowels.

Magnesia phosphorica. Intermittent pain relieved by bending forward, rubbing, and by external warmth.

Nux vomica. Constipation, flatulency, distension of the abdomen, urging to stool, vesical tenesmus, colicky pains with soreness and cramps.

When a diagnosis of appendicitis has been made by a physician a most serious responsibility confronts him. The advisability of an operation must be determined and the time of its execution decided upon. Faulty judgment may doom the patient to eternity. A proper understanding of the advanced status of professional opinion upon the subject should be familiar to every practitioner of medicine, that he may be able to intelligently consider the matter, and render such assistance to his patient as will most certainly aid in recovery. The universal conclusion of advanced thinkers in surgery is that all cases of appendicitis should be treated by laparotomy, and that the earlier the operation the greater the safety of the patient.

While an operation in the early stages for catarrhal, ulcerative or recurrent appendicitis is simple and safe it cannot be denied that where perforation has taken place, with extensive adhesions and accumulations of pus, it is a most difficult and unpromising procedure. When the fact is considered that advanced cases of appendicitis, with consequent sepsis, offer such gloomy prognoses, and on the other hand simple ones, before perforation has taken place, give almost universally favorable results, it

is but a rational conclusion that an early operation is to be commended in every case.

It is but proper to state just what would be considered an early operation. It may be defined as one that is performed before perforation has taken place, when the appendix can be excised, the abdomen closed without drainage, and sepsis eliminated from the category of dangerous factors.

The question that confronts the surgeon under such circumstances is: What are the indications for an operation, when will perforation take place? No definite time can be ascribed, for one case may go on with safety for several days while another of a fulminating variety will perforate and develop septic peritonitis in a few hours. Many cases are extremely deceptive in character, the disease running its course insidiously, no serious constitutional disturbances being present until perforation, or it may be gangrene, has taken place. The following formulated rules will serve as a guide in all cases:

First. If the condition offers indubitable evidence of pus operate at once.

Second. If the attack comes on severely, or if any of the symptoms are of a suspicious or doubtful nature, as soon as a diagnosis has been made operate.

Third. If the symptoms when called, though mild, have continued for more than a day or two, and especially if they are progressive, operate at once.

Fourth. If called at the beginning of a mild case and decided improvement does not take place in twenty-four hours operate.

Fifth. If the case, of any character, gives a history of a previous attack operate at once.

Sixth. In cases that are seemingly improving if any hectic symptoms exist, though slight, indicating the probable formation of pus, operate at once.

Surgical Treatment.—The technique is important; the surgeon should be familiar with every feature and requirement of the operation. Careful antiseptic precautions must be instituted and every step of the proceeding conducted with aseptic precision. An expert anesthetist, if possible, should be employed and, unless contra-indicated, chloroform is the lethean drug to be preferred; it is quicker in its action, holds the patient quiet, an important consideration, and is less liable to produce vomiting than any of the other anesthetics.

When operating for appendicitis in simple or uncomplicated cases the Trendelenberg position will be found to be the most convenient, but when purulent accumulations exist the dorsal decubitus should be employed, as it lessens the liability of the passage of pus to the upper abdomen and also facilitates the turning of the patient to either side, if necessary, to evacuate any quantity of sero-purulent matter that may be present.

The form and extent of the abdominal incision should vary according to the existing pathological condition and the consequent requirements of the case. In cases uncomplicated by extensive adhesions or effusions a short incision, two inches long, made through the right linea semilunaris will answer (Fig. 594), but when these conditions exist the opening should be extended to at least three or four inches. Where a

bulging or tumor is present, indicating an accumulation of pus, the incision should be made over its most prominent part, or the point of greatest dullness, in the direction of the fibres of the external oblique muscle (Fig. 595.)

OPERATION. A longitudinal incision from two to five inches, according to the condition, is made directly over

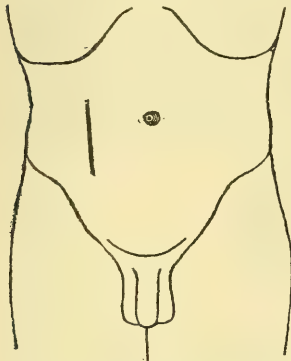


Fig. 594.
Incision Through Right Linea Semilunaris.

the cecum, along the dextral border of the right rectus abdominis muscle, dividing all the structures down to the peritoneum, all bleeding points being then secured with catch forceps. If the epigastric or a branch of the iliac artery is severed it should be ligatured with fine sheep-gut.

The peritoneum is then caught by two

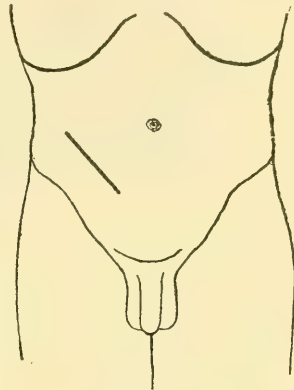


Fig. 595.
Incision in Direction of Fibres of External Oblique Muscles.

forceps, raised and nicked between them, and divided with the scissors over the palmar surface of the index finger. The presenting coils of intestines are covered with warm sterilized sponges, or gauze pads, and pressed toward the median line. The cecum is now sought and lifted up, which brings the appendix into view. If difficulty is experienced in locating the appendix it may be overcome by following downward the longitudinal band of muscle that connects its base with the anterior surface of the ascending colon. Its mesenteric or peritoneal attachment is transfixed and tied with medium-sized sheep-gut and divided with the scissors.

The outer coverings of the tube are now incised in a circular manner with the scissors, close up to the cecum, after which the inner structures are ligatured at this point with fine silk, or sheep-gut, Fig. 596, and the appendix cut away, the stump inverted as much as possible, and the peritoneum closed over it with a few small Lembert sheep-gut sutures, Fig. 597. This procedure covers the stump and insures against the possibility of infection of the peritoneal cavity from its diseased tissue; besides, it adds strength

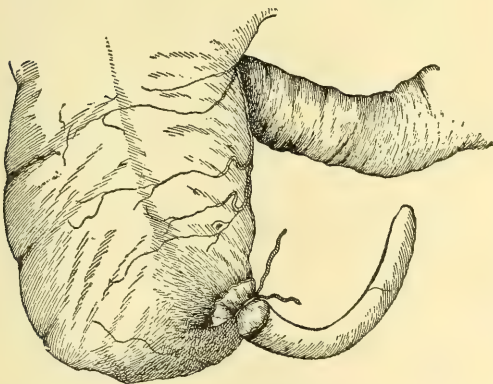


Fig. 596.

Inner Structures Ligatured with Silk or Sheep-gut.

to what otherwise would be a weak point in the intestinal wall.

Some operators are contented simply with ligaturing the appendix close up, excising it and cauterizing the stump with pure carbolic acid.

The wound is now cleansed and the abdomen closed by three rows of sutures; the first of medium-sized sheep-gut brings accurately together the peritoneum and transversalis fascia; they are securely tied and cut short. In introducing the second row of silk—approximating or sustaining—sutures the needle is entered in the skin, passed downward and outward, then inward, in a curved manner, including all the tissue down to the peritoneum, but not penetrating it; the needle is then re-entered below and passed upward in the same manner, coming out through the skin at a like distance from the edge of the wound on the opposite side, then drawn snugly, but not tightly, and tied. The skin is then coaptated by an occasional suture of fine sheep-gut. The wound is dusted with iodoform, and dressed with a plentiful supply of sterilized gauze held in position by a bandage.

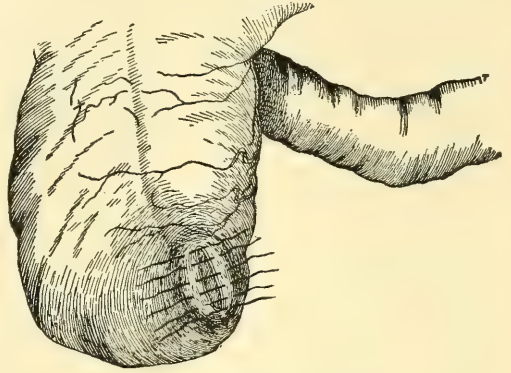


Fig. 597.

Lembert Sheep-gut Ligatures.

When complications exist the operative technique must be varied. If inflammatory exudations have taken place, uniting adjacent structures, agglutinating coils of intestines and destroying familiar features of tissue, it will be necessary to break up the adhesions, carefully working the way down until the cecum can be lifted up. These manipulations should be conducted toward the flank, not toward the median line. In turning out, or lifting up the cecum, if pus exists, whether lying free in the iliac fossa or bound in by adhesive attachments, it will well up into the wound. It should be received upon sponges as it appears and carefully removed, so as not to soil the viscera. If the abscess is circumscribed and small it should be surrounded or isolated, as it were, with sponges and evacuated; in any case all the pus must be removed by gentle sponging and cleansed with a twenty per cent. solution of peroxide of hydrogen; then again irrigated with a warm normal salt solution. Where the abscess is extensive and well walled in great care should be exercised in searching for and removing a partially disorganized appendix, lest a break be made that will allow the escape of purulent matter into the peritoneal cavity. It is better to leave it to be disposed of by the sloughing process; though some writers, as Morris, recommend that it be removed in all cases—after cleansing—and that the intestinal adhesions be broken up, the cavity cleansed and wick or absorbent gauze applied for drainage. In the event pus does enter the abdominal cavity it must be washed out with the normal salt solution. Neither water nor chemical disinfecting solutions should be introduced into the peritoneal cavity, as they will irritate and inflame the serous membrane and cause adhesive complications. When it is impossible to evacuate and remove the appendix Tait recommends that it be laid open by an incision made in its long axis, and drainage applied. If in such cases it is found that the gut has been perforated and has poured its contents into the abscess cavity it is useless to attempt its closure; the

infection would render the attempt nugatory and probably cause additional destruction of tissue. If possible the injured bowel should be brought forward and united to the median side of the abdominal wound; or it may be left undisturbed to nature, allowing the fistula to close as the cavity fills by granulation. In all cases in which pus has been found

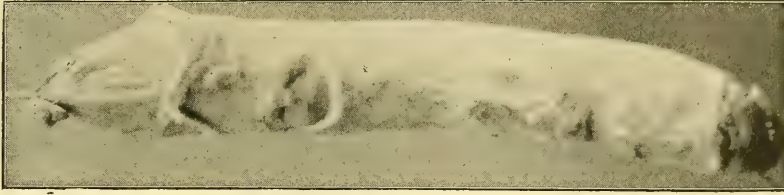
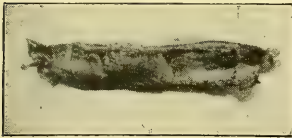


Fig. 598. Mammoth Appendix.

drainage in some form must be instituted. If the abscess is small it should be evacuated, the diseased tissue carefully curetted away (except it be the bowel, in which case it is brought forward and united to the margin of the abdominal wound), and cleansed with peroxide of hydrogen, then irrigated with a normal salt solution and a gauze drainage applied. The gauze should be as large as two fingers, infolded, so as to prevent ravelling, introduced to the full depth of the cavity and brought out at the lower angle of the abdominal wound. When an abscess has pocketed deeply into the iliac fossa, or lies in a position where drainage through the abdominal incision cannot be made perfect, an opening should be made in the flank at the most dependent part and a large drainage tube inserted, as well as one in the initial abdominal incision. When this is done better drainage is obtained and irrigation can be effectually carried out.



**Fig. 599.
Atrophied Appendix.**

In cases where much local peritonitis is present and extensive intestinal adhesions have formed, with consequent pocketing of pus, they must be broken up and the pockets of pus evacuated. The manipulations should be conducted in such a way as to turn the stream of purulent matter from the peritoneal cavity.

When drainage is used the upper part of the wound only should be closed, the lower angle being left free for drainage. The gauze should be removed at the expiration of the second or third day, according to the amount of fluid discharged. The quantity of peritoneal fluid discharged is sometimes so great that the external dressing requires to be changed every one to two hours. When this tendency to exudation ceases the gauze is of no further service and should be removed. The removal is sometimes difficult if suppuration is absent, but may be obviated by enveloping it in perforated gutta percha protective tissue. After the drainage is removed the cavity should be irrigated with a mild boric acid solution, five per cent. The peroxide of hydrogen may be used in the wound until suppuration ceases. If the condition indicates that the process of suppuration is going to be protracted the gauze drain should be replaced by perforated rubber drainage tubes. These tubes demand most careful attention; they must be frequently removed and

cleansed, and left in until the wound fills from the bottom. The dressings should be abundant, of moist bichloride or carbolic gauze, loosely folded, laid over the wound and covered with oil-silk, so as to retain the moisture and more readily absorb all the discharge.

The management of the case in general should be the same as in an ordinary case of abdominal surgery.

CHAPTER XI.

SURGICAL DISEASES AND INJURIES OF THE INTESTINES.

Anatomy.—In dealing with the surgical and topographical anatomy of the intestines there is no better exposition of the subject given than that found in the very excellent work of Smith on abdominal surgery, an abridgement of which is here given:

There is no definite topography of the small intestines, except at their extremities. The small intestine is disposed in an irregularly curved manner from left to right. The gut, starting from the duodenum, will first occupy the contiguous parts of the left side of the epigastric and umbilical regions; the coils then fill some part of the left hypochondriac and umbilical regions; they now commonly descend into the pelvis, reappear in the left iliac quarter, and then occupy in order the hypogastric, lower umbilical, right lumbar, and right iliac regions. Before reaching the latter situation, they commonly descend again into the pelvis.

Special interest attaches to a knowledge of the parts of bowel which usually occupy the pelvis. The parts usually found in the pelvis of an adult belong to the terminal point of the ileum, and to that part of the intestine which has the longest mesentery—the part, namely, which extends between two points, respectively six and eleven feet from the end of the duodenum. It is not, therefore, uncommon to find loops lying together in contact with the pelvic floor that are in reality some twelve or fourteen feet apart.

The attachments of the mesentery have little surgical importance in localizing a certain portion of bowel, and ascertaining the direction of it from duodenum to cecum; it may be of assistance to remember that the right layer of the mesentery is also its upper layer, and the left layer the lower. The upper layer is continuous with the lower layer of the transverse of the meso-colon, and also with the peritoneum which invests the ascending colon. The lower layer is continued over the descending colon, forms the mesentery of the sigmoid flexure, and descends into the pelvis. When the abdomen is not distended the length of the mesentery is such that any part of the small intestine can easily be raised up through an opening in the abdominal wall near the umbilicus. When the abdomen is distended it may be impossible to bring certain portions of bowel through a median incision. Normally the bowel cannot be dragged down below the level of the spine of the pubes.

The topography of the large bowel is more definite.

The direction of the ascending and the descending colon is vertical, and the transverse colon lies almost horizontally between them. The splenic flexure is higher than the hepatic, and lies deeper in the abdomen; and the transverse colon very frequently takes a bend downward. These bends sometimes descend a considerable distance, occasionally reaching the pubes; but they rarely get below the level of the crests of the ilia. They are sometimes quite acute, forming V-shaped curves.

The disposition of the ascending and descending meso-colon is of much surgical importance. A meso-colon is found upon the left side in thirty-six per cent. of all cases, and in the right side in twenty-six per cent. These facts are important when performing lumbar colotomy, for it is generally supposed that a meso-colon is more common on the right than on the left side.

The left meso-colon is usually attached along the outer border of the kidney, and is vertical. The right meso-colon is not quite vertical, but "crosses the lower end of the kidney from right to left, and then ascends along the inner border of the gland" (Treves).

In surgical operations on the intestines it is impossible to ignore the great omentum. Rarely is it found conforming to the anatomical description of it—spread out like an apron over the bowels. In many cases it is never seen, being placed high up, coiled or folded upon itself. In other cases it lies entirely on one side of the abdomen, usually the left. It may be twisted up like a rope, or spread out in one part and contracted in another; frequently it is adherent to bowel or parietes; sometimes it is partly embedded among the intestines. It may be thin and translucent or even cribriform, or it may be very thick and laden with fat.

The surgical anatomy of one part of the small intestine is the same as another. The four coats—serous, muscular, cellular and mucous—exist everywhere. The longitudinal muscular fibres are thickest along the unattached surface, and the muscular fibres generally are most abundant in the upper regions of the gut.

The free anastomosis of the intestinal vessels in the peritoneum has as much surgical significance on the one hand as their circular distribution in the intestinal walls on the other. Thus, though a piece of mesentery may be destroyed at a little distance from the bowel without impairing its vitality the smallest portion of bowel left without its mesentery closely attached to it may, and probably will, die.—(Grieg Smith.)

Intestinal Obstruction.—Surgical procedures for the relief of intestinal obstruction have, in the past, been attended by such a frightful mortality, even in the hands of the most skilled operators, that some of the ablest surgeons have declared themselves as opposed to surgical measures in the treatment of such cases. Such an appalling mortality has, however, been largely due to a lack of appreciation of the necessity for early operative interference and to faulty methods of diagnosis and operative technique.

The death-rate following operations for intestinal obstruction doubtless will always be greater than that following abdominal section for the relief of other conditions; because the operations necessitated are of themselves more dangerous, and the tendency of the conditions which give rise to obstruction are a source of great danger.

Since the introduction of antiseptic and aseptic measures, together with improved methods of diagnosis and operative technique, and the growing appreciation on the part of physicians and surgeons as to the imperative necessity for the early adoption of surgical measures in these cases, it may reasonably be expected that the mortality will, in the near future, be reduced almost if not quite to that attending other intra-peritoneal operations. Statistics upon the subject up to the present

time show that one death in every three to five hundred, from all causes, is due to intestinal occlusion of some kind.

Intestinal obstruction is the term used to designate a complete or partial closure of the intestinal canal, the result of mechanical causes. It has been variously classified, according to existing lesion. Some authors differentiate between those caused by an enterolith, an invagination, or the passage of a part of the gut into some opening, such as the obturator foramen, the foramen of Winslow, or an opening in the omentum or mesentery. The former they include under the head of intestinal obstruction; the latter under that of intestinal strangulation. Other classifications are made into true and false, acute, sub-acute, and chronic. For practical purposes the division into acute and chronic is of the greatest importance, and for operative purposes all-sufficient. The possibility of these two forms must ever be borne in mind.

Acute obstruction is due to a sudden diminution or complete obliteration of some part of the intestinal canal, usually in the small intestine. The more common causes of acute obstruction are invagination, volvulus, constricting bands, adhesions and gall stones or other foreign bodies. Absolute constipation is the most important indication of acute obstruction, though feces that are contained therein may pass from the bowel below. Severe paroxysmal pain is always present. Vomiting is an early symptom as a rule, but occurs much earlier in some cases than in others; it is most severe if the obstruction is high up in the gut; distension of the abdomen is most marked if the occlusion be low down. If the obstruction be due to invagination the abdominal wall is usually retracted.

Chronic obstruction occurs most frequently in persons of advanced years, and is usually located in some part of the large intestines. The symptoms generally develop slowly, becoming more and more severe as the disease advances; acute symptoms, however, may arise suddenly at any time, from blocking of the canal. There is generally a history of digestive derangement, with gradually increasing constipation. At times there may be alternating diarrhea and constipation. Pain is a prominent symptom, is paroxysmal and colicky, and as a rule, comes on some hours after taking food; vomiting and abdominal distension develop later.

Enterolithiasis.—This term signifies the formation of enteroliths—the condition of having them. An enterolith is literally an intestinal concretion formed by deposits of lime salts around a foreign body. Enterolithiasis is most frequently due to a gall-stone which has become impacted, or to an enterolith which usually has for its nucleus a gall-stone. Many theories exist as to how a gall-stone large enough to cause obstruction finds its way into the intestinal canal. The opinion now prevails that stones of large size escape from the gall bladder and enter the intestinal tract by a process of ulceration; and that the stones small enough to pass through the bile ducts cause obstruction only when they remain in the intestinal canal long enough to attain, by concentric accretion, much greater dimensions than when they passed through the ducts.

Obstruction from a biliary calculus is located in the lower part of the ileum in fifty per cent. of the cases, the upper part of the jejunum being the next most frequent site. In a few instances it is located in the duodenum, and it is probable that when located here the stone attained its size in the gall bladder and reached the intestine through ulceration. A

foreign body in the intestinal canal does not give rise to obstruction until tissue changes, incident to the irritation produced by its presence, occur in the walls of the gut. If the symptoms from the outset do not correspond to those of acute obstruction there will likely be indications of a previous bowel disorder. In cases where the origin is found to be a gall stone a history of biliary colic will be obtained, and some liver trouble, with jaundice, will exist. If the obstruction is high up vomiting is an early and prominent symptom, and but little if any tympanites will be found; when it is low down the vomiting ensues later and the abdominal distension will be greater.

TREATMENT. Cathartics are of doubtful utility, if not absolutely harmful. When the obstruction can be located near the ileo-cecal valve or in the colon and the case is seen before severe injury to the structures has taken place injections and massage may be tried; but usually at the time the case comes under the observation of the surgeon the tissue changes are such as to render operative procedure imperative.

The abdomen is opened in the median line, and the bowel at the seat of the impaction brought well into view. Owing to the lowered vitality of the gut at the site of the impaction it must never be attacked at this point, unless absolutely unavoidable. If the object can be easily displaced, either upward or downward, into an area of healthy tissue an effort at sub-mural crushing should be made. Manual pressure may be tried, and if this fails a strong needle is passed in an oblique direction through the intestinal walls upon one side or the other of the impaction and an effort made to break it up. The needle should, if possible, always be passed through healthy tissue. If the impaction can be thus broken up the fragments may be pressed into the sound part below and the seat of puncture covered over with peritoneum, held in place by stitching to prevent leakage. When the impaction cannot be readily broken up, all efforts in this direction must cease, as prolonged manipulation of the injured structures can result only in harm. The stone, or concretion, must be pushed upward or downward, if this can be readily done, until it is within healthy bounds, and an incision made in a longitudinal direction on the convex surface of the intestine opposite its mesenteric attachment. The proximal end must be emptied of its contents, the stone extracted and the visceral wound sutured. If the stone cannot be displaced and the incision has to be made through the injured tissues an omental graft covering the incision should be placed around the intestine after its ends have been stitched together.

If gangrene exists resection, followed by lateral anastomosis, will have to be done. Circular enterorrhaphy in these cases is not practicable, owing to the great dilatation existing in the proximal end.

Parasites.—In rare instances obstruction is caused by an accumulation of worms in the intestinal canal, which should be remembered in treating occlusion in children. When anthelmintics followed by cathartics fail to relieve, operative treatment must be instituted. The procedure is the same as in intestinal concretions.

Fecal Obstruction.—This is always found in the large intestine, the most frequent sites being the regions around the sigmoid flexure and cecum. It is caused by prolonged over-distension, or by accumulated fecal matter, and results in a parietic condition of the distended portion.

An abnormal congenital dilatation of a part of the colon predisposes to fecal accumulation and obstruction. The symptoms are much the same as in chronic obstruction from other causes. A history of constipation, or alternate diarrhea and constipation, is obtained upon inquiry. A distinct and well-defined tumor can usually be outlined. The retained feces become hardened and form concretions around the interior circumference of the gut wall, an opening frequently remaining in the middle for the passage of fecal matter. After a time irritation and inflammation of the tissues of the bowel set up, accompanied by pain, distension of the abdomen and dyspnea. Sometimes the tissues around the intestine become involved in the inflammatory process and an abscess forms, or it may be perforation takes place.

A diagnosis is made from a review of the history of the case, and the presence of a distinct and well-defined tumor which, when firm pressure is made over it with the fingers, may become indented from displacement of the fecal masses, the depression permanently remaining. This very important diagnostic procedure, to be available, must be practiced when the patient is under an anesthetic.

A fecal impaction in the cecum has been mistaken for other forms of tumor.

TREATMENT. If the patient is seen early, before the bowel has become inflamed or lost its contractile power, the administration of cathartics may succeed in breaking up and dislodging the impacted mass. Purgatives must never be used if there is much inflammation of the bowel, or if it has lost its contractile power; in the one instance they would be harmful while in the other they would do no good. When the mass is low enough down to be reached it may be removed by the spoon or scoop, aided by injections. If too high up to reach with these implements large injections of warm water, or oil and water, slowly introduced and retained as long as can be borne, is the proper treatment.

When the impaction cannot be removed by the means above indicated laparotomy must be done, the fecal mass broken up by the methods indicated in obstruction due to concretions, and pressed down into a healthy part of the gut. If the vitality of the bowel at the seat of impaction has become so lowered through circulatory changes as to render such manipulations improper the only resource left is to make an artificial anus in the corresponding inguinal region. A perforation or an abscess caused by fecal obstruction must be met promptly by operative measures.

As a recurrence of the trouble is not infrequent an effort should be made to tone up the contractile force of the weakened and distended parts by the administration of such internal remedies as may be indicated. Electricity and massage may be brought into requisition as powerful adjuncts.

Intussusception.—This is that form of obstruction caused by the invagination or doubling of one portion of the bowel into another. A good illustration of the mechanism of the condition is obtained by catching a glove-finger at its middle and doubling one part into the other. Thus it will be seen that an invagination consists of three walls: an outer-receiving sheath, the intussusciens, and two inner ones, the intussusceptum. If the intussusceptum points downward the invagination is said

to be descending; if upward, ascending. Descending invagination is the common form, the ascending being rarely met with.

Intussusception may result from diarrhea, ulceration of the mucous membrane of the intestine, irritation due to the presence of worms, or a tumor attached to the inner surface of the gut, dragging the part above down into that below. Treves estimates that thirty per cent. of all cases of intestinal obstruction are due to the last named cause. Age is a prominent predisposing factor in the disease, it being estimated that more than one-half of the cases are found in children under ten years old.

SYMPTOMS. The symptoms of acute intussusception are severe spasmodic pain, gradually becoming constant, with acute exacerbations; collapse, mucous and bloody discharges, with occasional scybala; tenesmus, which is most distressing if the invagination is in the rectum. Later, nausea and vomiting usually occur, but not always, and fecal vomiting takes place if the obstruction becomes complete. Retraction of the abdominal wall is usual, distension appearing only when there is complete stoppage. An elongated cylindrical tumor can generally be detected unless the abdomen is distended. At first only a tender spot may be found over the site of the invagination, but later the entire abdomen becomes sensitive to the touch, and unless the condition be soon relieved the gut becomes gangrenous, perforation results and the patient succumbs to septic peritonitis.

Obstruction from intussusception is not due entirely to occlusion of the intestinal lumen, but also to changes that take place in the invaginated portion. The constriction at the neck of the intussusciens prevents the free return of the venous blood from the intussusceptum, the parts become swollen and edematous, and, if the strangulation is severe, complete stasis and gangrene follow.

Adhesions, due to plastic inflammation, form between the serous surfaces of the intussusceptum, except in those instances in which gangrene of this part takes place within a few hours. It is said that adhesions form in about forty per cent. of acute cases. When death occurs it is from septic peritonitis following perforation at the neck of the intussusciens. If gangrene sets in recovery takes place only when firm and unyielding adhesions form at the neck of the intussusciens, the line of demarcation falling below this point, the intussusceptum being eliminated by sloughing. Gangrene starts at the apex of the intussusceptum and spreads towards its neck, the length of the slough depending upon the length of the intussusceptum. Elimination of the sloughing takes place in about forty per cent. of all cases, and occurs more frequently in adults than in children. Cicatricial contraction usually follows and may be sufficient to cause stricture of the gut, which may again produce obstruction.

The symptoms of chronic invagination are much the same as are found in intestinal stenosis from other causes. They are not so severe, however, as those of the acute form, but may extend over an indefinite period of time. A history of digestive derangement, constipation, or alternate diarrhea and constipation, is usually found. Blood may or may not be present in the dejecta, and tenesmus usually exists, but is not a constant symptom. Pain is paroxysmal, but not continuous, the patient experiencing complete relief in the intervals. Nausea and vomiting are usually present, and generally occur during a paroxysm of pain. A

tumor can be found only in about fifty per cent. of the cases and, as a rule, there is abdominal tenderness, either local or general. Distension does not occur unless the bowel becomes blocked by the intestinal contents, when acute symptoms supervene.

The bowel at the site of the invagination is congested and swollen, but not to so great an extent as in acute cases, owing to a lesser degree of constriction of the blood vessels supplying the parts. The walls of the intestine at the seat of the invagination, and above it, become hypertrophied through the irritation incident to increased peristalsis, and from the chronic congestion that accompanies the disorder. Gangrene does not occur, the degree of constriction being insufficient to completely arrest the circulation of the parts.

DIAGNOSIS. The diagnosis of intussusception must be made from a careful review of the clinical history of the case. Special stress should be placed on the discovery of an elongated cylindrical tumor, retraction of the abdominal wall, bloody mucous dejecta and tenesmus. Age is an important factor in establishing a diagnosis in doubtful cases of acute character. If the patient is a child under ten years old the diagnosis of intussusception is pretty clear, other indications favoring such a conclusion. Invagination has been ascribed as the cause of seventy-five per cent. of all cases of obstruction occurring in children.

TREATMENT. The general condition of the patient merits the first consideration. If the symptoms point to the existence of an acute trouble the stomach should be emptied and irrigated with some mild alkaline antiseptic solution; the patient should be put to bed and kept at rest, and the warmth of the body maintained by artificial heat. All food by the mouth must be interdicted and a hypodermic of morphia given in sufficient quantity to allay the pain and arrest the violent peristalsis going on in the proximal end of the gut. An effort should first be made to reduce the invagination by distending the bowel below the obstruction. This treatment, if practiced early, and before unyielding adhesions have formed, offers a fair prospect of success. Distension of the bowel is accomplished best by rectal insufflation of hydrogen gas, or filtered air. Another agent for this purpose is water, but its use is open to serious objections on account of its weight, and from the great amount of pressure exerted by its introduction there is danger of an injury and even rupturing of the bowel; furthermore, a large quantity of water in contact with the bowel increases the tendency to diarrhea. Hydrogen gas is the safest and most efficient agent with which to overcome the condition. Its advantages consist in its extreme lightness, its non-toxic, non-irritating nature, and its ready removal by absorption. The ileo-cecal valve, in the healthy adult, yields readily to rectal insufflation of this gas under a pressure of one and a half to two and a quarter pounds to the square inch. Before distension is undertaken the bowel must be flushed by a high enema of two to four quarts of warm water, the patient being in the knee-chest position. This should be done without anesthesia, so that pain may serve as a warning to stop. The patient is then completely anesthetized and the distension with gas slowly and steadily made, care being taken that the pressure does not exceed two pounds to the square inch. If a tumor can be felt the hand should be placed upon it. A sudden diminution of pressure and disappearance of the tumor

indicates either that the invagination has been reduced or the bowel has been ruptured. The insufflation should be then continued gently, but with a pressure not exceeding one-half pound to the square inch, when if disinvagination has occurred, the distension of the bowel above will proceed uniformly; first above the pubes and middle of the abdomen, and gradually upward, as the insufflation is continued; but if rupture has taken place general distension of the entire abdomen will be seen.

If efforts at reduction by insufflation fail, or rupture of the bowel follows, laparotomy is the only alternative. An incision in the median line is made, the invagination brought into view, and the condition of the bowel carefully noted. If the gut is gangrenous all efforts at reduction would be worse than useless and resection must be done; but if it presents no evidence of gangrene further efforts at disinvagination should be made. The edema and swelling are first to be reduced as much as possible by grasping the invagination with the hand and exerting steady and continuous pressure. When the swelling has thus been reduced the bowel is grasped with the hands above the neck of the intussusciptions, and below the apex of the intussusceptum, and traction made in opposite directions, together with pressure from below, against the intussusceptum. If reduction is not accomplished in this way rectal insufflation must again be used, and when the bowel between the intussusceptum and intussusciptions becomes distended with gas traction is again practiced. Should the invagination still persist a probe must be inserted between the intussusceptum and its sheath, the adhesion broken up by gentle manipulations, and another attempt made at reduction by insufflation and traction. If reduction is accomplished the mesentery must be shortened to prevent a possibility of a recurrence. This can be done by folding the mesentery upon itself, parallel to the bowel, and making the fold permanent by a few sheep-gut stitches. Any rents in the serous coat and patches of gangrene must be covered by stitching the peritoneum over them. All efforts at reduction proving futile, resort must be had to resection, and the continuity of the intestinal canal be restored by circular enterorrhaphy or lateral anastomosis.

The treatment of chronic invagination does not differ in any essential particular from that of the acute form, except that there is not the same urgency for radical measures. It is not proper, however, to delay the operative treatment too long, lest irreparable pathological changes occur. It must be borne in mind that a complete block may take place at any time, the chronic condition being converted into an acute one. These cases should never be left to nature, for the patient's situation becomes more and more dangerous, and elimination of the intussusceptum occurs only in about forty per cent. of all cases, and almost never in children.

Volvulus.—This is the term applied to intestinal occlusions caused by a twisting of the bowel; it is the rarest of all intestinal obstructions, and is always acute. There are three forms of this disease. In the first, which is of infrequent occurrence and is located in the colon, the bowel is simply twisted upon itself. In the second and most common form a loop of intestine, in which the two strands of the bowel are situated in close relation, becomes twisted upon its axis. In the third two loops in separate portions become twisted around each other.

The lesion is probably due to a sudden movement, or contortion of

the body, causing the dependent loop to turn upon its axis; the dependent position and the pressure, or interference, of adjacent viscera prevent its restoration. Volvulus can only occur when there is an elongated mesentery, and for this reason is most frequently found in those situations in which the mesentery is naturally long; viz.: at the sigmoid flexure, and in the lower part of the ileum. The cecum is sometimes involved when there is a long meso-colon.

Venous congestion promptly follows, and the arterial circulation is to a greater or less degree obstructed; owing to the interruption in the lumen of the gut rapid distension of the loop with gases occurs, and ulceration of the mucous membrane above the seat of constriction, or sphacelus, rapidly supervenes.

The most prominent symptoms are absolute constipation, colicky pain, which gradually becomes continuous, and tenderness over the site of the lesion, with a corresponding area of tympanites. Tenesmus is a constant symptom if the occlusion is near the rectum. Vomiting comes on early and is persistent if the twist is located in the small intestines, but is less persistent if it is in the sigmoid flexure. Abdominal distension usually takes place within a few hours. In the early stages the volvulus may be outlined through the abdominal walls, but later, when peritonitis sets in, the real condition is obscured by the general tympanites which follows.

TREATMENT. This is the most rapidly fatal of all the forms of intestinal obstruction, and unless prompt surgical treatment is instituted death inevitably results. There is a possibility that rectal insufflation, if practiced sufficiently early, before the parts have become distended by the intestinal contents, may succeed in reducing the twist. If it does not yield readily to insufflation laparotomy must be done. If serious pathological changes have not taken place it can be readily reduced; but if firm adhesions have formed it may become very difficult, if not impossible, to restore the bowel to its original condition. If reduction cannot be effected without it an incision should be made in the distended bowel, its contents evacuated, the incision sutured and reduction again attempted. If the reduction can be effected the elongated mesentery must be shortened by folding it upon itself and making the fold permanent by fine sheep-gut stitches taken parallel to the mesenteric vessels, in order to prevent a recurrence of the condition. All efforts at reduction failing, resection should be done, and the fecal circulation restored by circular enterorrhaphy, lateral implantation or lateral anastomosis. If the condition of the patient be such that the time required for resection would prove dangerous the twist should be left and the continuity of the canal restored by lateral anastomosis. If the gut is gangrenous resection becomes absolutely necessary.

Tumors.—Tumors give rise to obstruction in various ways, according to their character and relation to the gut. Polypoid growths spring from the mucous membrane or sub-mucous connective tissue. If the tumor is pedunculated it drags upon the bowel above, and by its weight produces a flexion or invagination, or, what is very rarely the case, may attain such a size as to cause obstruction of the canal. In rare instances cysts may form on the interior of the intestine, and as a rule the occlusion is complete. Ovarian and other tumors on the outside may

also cause obstruction from compression, the gut being caught between the tumor and a fixed point. Such causes are most frequently found in women from the fact that tumors are more common in them than in men. Malignant growths also produce stenosis; they are of the sarcomatous and carcinomatous varieties.

Sarcoma develops in the muscular wall, beneath the mucous membrane, while carcinoma starts in the mucous membrane and glands. Carcinoma is generally met with in the large intestine, below the ileocecal valve—the cecum, sigmoid flexure and rectum being its most frequent sites—while sarcoma is most frequently encountered in the small intestine.

DIAGNOSIS. It is very desirable in these cases to arrive at a correct diagnosis on account of the important bearing it has upon the prognosis. The differential diagnosis must be made from the clinical history of the case, as to the location of the obstruction, the presence or absence of a tumor, the prominence of the abdominal symptoms and the rapidity with which the general health deteriorates. The presence of a tumor on the interior of the gut is rarely discovered prior to operating, while a tumor on the outside, as a rule, can be readily outlined. In malignant stenosis an enlargement can usually be outlined, the general health rapidly deteriorates and the abdominal symptoms are not so marked. An examination of the rectum should never be omitted.

TREATMENT. In the case of benign tumors, and where there are no secondary mechanical complications, as a flexion or an invagination, laparo-enterotomy must be done and the tumor removed. A longitudinal incision of sufficient size to permit of ligating the pedicle and removing the growth should be made on the convex surface of the gut and the wound sutured. If secondary complications are found, such as a flexion or an invagination, they must be treated as heretofore described.

In case the neoplasm is a sarcoma its extirpation is hardly practicable. By the time symptoms of obstruction appear infiltration and infection of the tissues surrounding the bowel will have taken place and removal of all the diseased structures will be an impossibility. The tumor should be left undisturbed and the fecal circulation restored by lateral anastomosis of the gut above and below it.

In carcinoma the progress of the disease is less rapid, and, if a diagnosis is made sufficiently early, and before infiltration of the surrounding tissue and infection of the glandular appendages have taken place, it may be possible to excise the diseased portion and restore the continuity of the gut by circular enterorrhaphy, lateral anastomosis, or lateral implantation; or, if the divided ends cannot be brought together and lateral anastomosis or lateral implantation is rendered impracticable by the inaccessibility of the distal end this should be closed by invagination and the proximal end fixed in the wound. If, on account of the extent of the diseased tissue, a radical operation cannot be done the obstruction should be excluded from the current of the canal by lateral anastomosis, or lateral implantation, if the bowel below is accessible. If not accessible, however, an artificial anus must be established in the right or left inguinal region, according to the seat of the disease, and the median incision closed and dressed separately. If possible to definitely locate the obstruction in the colon or cecum before the abdomen is

opened a primary lateral incision is preferred, as affording easier access to it.

Stenosis.—This condition may be either congenital or acquired. The essential cause of congenital occlusion of the bowel is faulty development.

Various pathological conditions may give rise to acquired stenosis. It may be due to contractions consequent to ulceration of the bowel, or it may result from inflammatory contractions and thickenings of the peritoneum incident to peritonitis. Again, it may be caused by an injury to the bowel in operating for hernia; it may also follow the cicatricial narrowing that results after the spontaneous elimination of the intussusceptum in an invagination. When cicatricial contraction is the cause of stenosis there are usually two strictures located at different points. In operating this must be borne in mind lest one of them be overlooked. Obstruction does not usually follow a narrowing of the lumen of the gut, unless it be diminished more than one-half; where the constriction is not complete the accumulation of the intestinal contents above it causes the occlusion.

The symptoms are necessarily the same as in chronic obstruction from other causes.

When acute symptoms develop on account of chronic obstruction of the bowel (partial obstruction) the same treatment is demanded that would be were it primarily an acute lesion. The indications for operation are the same. The line of procedure must be determined at the time of the operation according to the exigencies of the case. When cicatricial contraction is the cause of occlusion and the vitality of the parts has not been impaired the continuity of the intestinal lumen is best restored by lateral anastomosis, care being taken to include all the contractions, if more than one exists, in the isolated area. This is considered a safer method than excision in such cases. If there is not an absolute closure at the point of contraction fear need not be entertained that marasmus will result, though several feet of the intestinal tract may be turned out of the direct line of fecal circulation. If gangrene exists, however, resection must be done, and the intestinal continuity restored either by circular enterorrhaphy or lateral anastomosis.

CHAPTER XII.

INTESTINAL OBSTRUCTION—CONTINUED.

Occlusion from Bands, Flexions and Adhesions.—Strangulation from these conditions causes a considerable number of cases of intestinal obstruction. Treves estimates that one-fourth of the total number of cases are produced in this way. Of these one-third are due to false ligaments, one-fifth to the omentum, and more than one-fifth to Meckel's diverticulum.

It matters not how the band may have been produced it is always liable to engage a knuckle or a loop of intestine, and is, therefore, a constant menace to life. When the intestine is once engaged in the opening it rapidly becomes congested and constricted, or else, if the loop is long, it twists upon itself and soon becomes filled with intestinal contents. Even bands that are attached only at one end, that are long, may entangle a coil of intestine. It may become adherent through inflammatory causes and leave an opening into which the intestine may engage. Meckel's diverticulum, which springs from the ileum a short distance above the cecum, and is directed forward toward the umbilicus, is a great source of danger. It sometimes projects like a fibrous cord, or may terminate in a club-shaped extremity; again, it may form a secondary attachment. In such cases it acts like a fixed band, under which an intestine may insinuate itself. There are many ways in which this diverticulum may ensnare the gut and produce obstruction. Adhesions about the appendix vermiformis, Fallopian tubes, or the pedicle of an ovarian tumor, where a space is left open, may engage an intestine after adhesions incident to intra-peritoneal operations. The remains of the umbilical artery may also act as a band of constriction.

Flexions.—A flexion may give rise to obstruction from cicatricial contraction of a plastic inflammatory exudation and thickening, but does not do so as long as the bowel at that point remains free. A compensatory dilatation of the bowel wall goes on until the intestinal lumen is brought up to the normal size. If, however, the bowel has become fixed at the point of flexion, or if from any cause dilatation cannot take place, obstruction results from pressure of the contents of the proximal upon the distal end. The entire circumference of the gut at the point of flexion may become so firmly imbedded in a mass of inflammatory exudative matter that the peristaltic action of that portion is completely arrested, and in this instance compensatory dilatation cannot go on.

SYMPTOMS. The symptoms in these affections are so nearly the same as to make it impossible to differentiate between them. The advent of the disease is usually announced by sudden acute, paroxysmal pain, with perhaps collapse, pulse quick and weak, temperature normal or lower, unless there be acute peritonitis, rapid respiration, localized or general sensitiveness of the abdomen, with distension, vomiting, which

soon becomes fecal unless the obstruction is too high up, foul tongue, thirst and scanty urine.

TREATMENT. The treatment is entirely operative. All adhesions must be separated if practical, the tube straightened out and, if possible, prevented from assuming the same relations, by placing it in another part of the abdomen. All raw surfaces, when it can be done, should be covered over by peritoneum stitched in place. If the bowel cannot be liberated without doing serious injury, or its continuity cannot be restored by separation of the adhesions, and there is no indication of gangrene, the adherent and flexed portions are to be left undisturbed and the continuity established by anastomosis between the parts above and below. If a flexed portion can be easily separated it may be removed and the tube rendered patent and straight by excision of a V-shaped piece. All bands are to be ligated close to either attachment, divided between ligatures and removed. The appendix and all diverticula require to be entirely removed and the wound closed with sutures. Small spots of gangrene may be cut out by an oval incision and the wound sutured. If gangrene is too extensive to admit of this procedure resection of the whole circumference becomes a necessity.

Adynamic Obstruction.—Suspension of the peristaltic action of the bowel may of itself give rise to symptoms of obstruction when no stoppage of its lumen really exists. This is due to paresis, the result usually of some inflammatory condition, or it may be of a reflex origin, the bowel structures remaining unchanged. In these cases the intestine having lost its contractile power and being unable to push along its contents, they accumulate in the paralyzed portions and undergo fermentation or putrefaction, thus producing distension with its attendant results. This parietic condition of the bowel may be brought about by sudden over-distension by gases, catarrhal or ulcerative enteritis, peritonitis, or it may follow operations in which eventration of the intestines has been practiced. Sudden accumulation of gases in the intestines in a mild form is not an infrequent occurrence, and is much more frequent in men than in women. It may be caused by excesses in diet in persons already suffering from temporary nervous exhaustion. It is first made manifest by severe colicky pain referred to the umbilicus, vomiting, and the passage, it may be, of some little flatus. At this stage there is excessive peristaltic action of the intestines, so much so that their movements may be seen. In a little while the pain subsides, the vomiting and peristalsis cease and the trouble apparently is over; but soon distension occurs, vomiting commences again and may possibly become stercoraceous. No gases are expelled per rectum, the respirations are rapid and labored, the face wears an anxious and haggard expression. In this condition the gaseous distension is the result of a paralysis of the sympathetic nerves. The gases do not escape because of the parietic condition of the bowel and the formation of flexions with pressure of the distended loops upon other parts.

Peritonitis sometimes presents symptoms so closely resembling acute obstruction that to differentiate between them by the physical signs presented becomes an impossibility. The arrest of the fecal circulation may be due to a plastic inflammatory exudation which so completely envelops a portion of the bowel as to prevent peristalsis, or to tympanites

alone, or, if perforation occurs, to paresis of the sympathetic nerves, the result of shock. Differentiation of these conditions from acute obstruction at times cannot be done. The principal points of difference may be summed up as follows: in acute obstruction there are absolute constipation and fecal vomiting, the distended loops of intestine being sometimes visible through the abdominal wall, the temperature is either only slightly elevated or normal, the pain is sharp and colicky and violent peristalsis continues over an indefinite period. In sudden over-distension by gases there are much the same symptoms, with these exceptions: the abdominal distension is greater, and on that account the intestinal coils are not seen, fecal vomiting rarely occurs, and peristalsis ceases soon after the commencement of the attack. In peritonitis the abdominal distension is also greater, the distended loops being invisible, the temperature attains, usually, a considerable elevation, and the pain is continuous in character. In gaseous distension from peritonitis the liver becomes displaced, and instead of the usual dullness on percussion when the patient lies upon his back there is tympanitic resonance; while with gaseous distension of the bowel alone the percussion dullness remains unchanged.

TREATMENT. In these cases, if seen before paralysis of the bowel has occurred, treatment should be directed toward giving the excited and irritated bowel rest, and the restoration of its nervous tone. This is best accomplished by putting the patient to bed and conserving his strength by quiet and warmth, and administering the indicated remedies. A selection can usually be made from the following:

Asafetida. Great distension of the abdomen, with severe pain, better from warmth; nausea and vomiting, great anguish and tossing about.

Carbo vegetabilis. Fullness and distension of the abdomen, with a feeling as though it would burst; great oppression of the chest, belching, taste sour and rancid. Symptoms alleviated by the emission of flatus.

China. Distension of abdomen with pressing pain, rumbling in the bowels, disease coming on after severe sickness or prostration.

Chamomilla. Flatulent colic, abdomen distended like a drum, rumbling in the bowels, constant passage of small quantities of flatus, restlessness and peevishness.

Colocynth. Violent cutting pains in the umbilical region; the patient is relieved by pressure and bending forward.

Lycopodium. Great bloatedness, most prominent in left hypochondrium, feeling as if the abdomen would burst, belching without relief, constipation with urging to stool.

Nux vomica. Flatulent distension of the abdomen, inability to belch, great pressure against the chest, also downward against the rectum, constipation, urging to stool without effect.

If treatment by internal remedies fails a hypodermic of morphine sufficient to arrest the peristalsis going on must be given, the stomach evacuated and irrigated, and the ingestion of food and fluids by the mouth interdicted. When the bowel has thus been quieted and a rest of a few hours allowed an effort should be made to move them and for this purpose sulphate of magnesia is a superior remedy. It may be given in

doses of one-half ounces, repeated every two hours. If a movement of the bowels can be induced the trouble is practically over.

If the case is not seen until after paresis has taken place the administration of the ordinary internal remedies will not be effective, therefore, an injection of morphine should be administered, the stomach emptied and irrigated, as heretofore directed, the colon washed out and a turpentine enema given. A most efficient method of administering it in such cases is in the following combination:

℞	
Magnesii Sulph.....	℥ j.
Ol. terebinthinæ.....	3 iv.
Glycerini.....	
Aquæ.....	a a fl 3 iv.
M. Sig.: To be used at one injection.	

This will usually cause a prompt and copious evacuation of the gases. Uniform pressure over the abdomen by means of padding and strips of adhesive plaster must also be made. In these cases Senn recommends puncture of the bowel, followed by aspiration, the procedure being repeated at short intervals if necessary; also, in case the abdomen is opened, to make one or more incisions into the bowel, empty it of its contents and close the wounds. Keith contends that all operative measures are quite useless, and that should a mistake in diagnosis lead to opening the abdomen the bowel should not be disturbed, as any interference with it cannot accomplish the results and will lessen the chances of its recovering its tone. The puncturing of the intestines is certainly not effective, and should be condemned; but in case the abdomen has been opened an incision of the intestinal wall and evacuation of its contents, accompanied by a flushing of the bowel with a warm, mildly alkaline solution, is certainly to be commended.

CHAPTER XIII.

INJURIES OF INTESTINES.

Etiology.—Injuries to the intestines are caused most frequently by penetrating wounds of the abdomen, such as gunshot or stab wounds, and by contusions and lacerations, the results of a blow, a fall, or passage of the wheel of a vehicle over the abdominal regions. The symptoms in these cases are by no means characteristic and consequently are not much to be relied upon as indicating the extent of injury done. In some cases there are but little pain and shock, while in others they may be very great. When the shock is severe nausea, vomiting and pallor are usually present, and if there is much hemorrhage the pulse becomes small, weak and frequent.

In gunshot and stab wounds the only reliable indication that the intestine has been perforated is the escape of intestinal contents through the abdominal wound, and this rarely happens. The first symptoms are pain and collapse from shock or hemorrhage, and if prompt treatment is not instituted septic peritonitis, with its train of symptoms, soon follows.

When called to treat a gunshot wound of the abdomen the first duty of the surgeon is to ascertain if the peritoneal cavity has been entered. A history of the accident, a study of the position of the patient when the injury was received, and the direction from which the missile was fired, consideration of objects or structures that might deflect the ball, and the appearance of the wound are all subjects for consideration. After thoroughly cleansing the patient and rendering the wound region aseptic a probe, if carefully and gently introduced into the opening, may give the desired information. A more rational method where doubt exists is to make an incision over the wound, dividing the tissues layer by layer until the peritoneum is reached, when the extent and character of the injury may be ascertained. If the abdominal cavity has been entered the next step in the investigation is to determine, by visual inspection, whether or not the viscera have been perforated. This may be conclusively demonstrated by inflating the bowel with hydrogen gas. If the intestines have been perforated the gas will pass through the perforation and general distension of the abdomen occurs, with escape of gas through the abdominal wound. If there is any doubt as to whether the gas is escaping from the abdomen a lighted match held close to the abdominal wound will clear it up. If gas is passing out it will ignite. The flame can be extinguished by holding a damp sponge over the wound. If the intestines have not been perforated it may become a question as to whether the abdomen should be opened or not, as all cases, even when the peritoneum has been entered, do not require abdominal section. If, however, it is shown that the intestines have been perforated, or there is any indication that a severe injury has been sustained, the abdomen should be opened at once, unless there is severe shock and the indications do not point to hemorrhage as the cause.

The usual precautions to keep up the strength and natural heat of the body must be observed.

The incision should be made in the median line sufficiently large to admit of easy manipulations. If there has been hemorrhage the accumulated blood must be removed by sponging or washing out with warm water, and all bleeding points ligated. The bowel should then be slowly and steadily inflated per rectum with hydrogen gas, and a sharp watch kept for its escape. The point at which an opening exists is readily discovered from the leakage of the gas, the coils below being distended while the bowel above does not become inflated. If there is any difficulty in locating the exact site of the leak the coil of intestine must be drawn out of the wound and gone over with a lighted match or taper held in close proximity to it, when its presence will be shown by the gas becoming ignited at that point. The first opening discovered must be marked, the tube removed from the rectum and replaced by another aseptic one, the distended portion of the bowel emptied of gas, as nearly as it can be done by introducing a long tube into the rectum, and the bowel be again inflated through the perforation. If another opening is found the gas is expelled as before and the first opening closed, the bowel inflated through the second opening, and so on until all of the bowel has thus been gone over. By a careful application of this method it is hardly possible to overlook any perforations that may exist.

If the margins of the wound are bleeding the hemorrhage should be arrested by hemming them around with an over and over continuous suture of fine silk or sheep-gut. The opening is then closed by a row of sutures which takes firm hold of the sub-mucous tissue; this may be supplemented, if necessary, by a few additional stitches.

The line of union should be transverse to the long axis of the bowel, as stenosis and interruption of the blood supply is less likely to occur than when it is longitudinal. An omental graft is then placed around the bowel over the line of suturing, and retained by a few stitches when the vitality of the part has been impaired to the extent that it is likely to prevent union.

When the mesentery has been so injured as to interfere with the blood supply and gangrene is likely to result, or when severe perforations are found very close together and the vitality of the bowel is affected beyond a possibility of recovery, resection becomes necessary.

Keith suggests that when the operation is a prolonged one and there are several openings to be closed it might be better to draw the part of the bowel whose mesentery has been injured into the wound and fix it in that position, the rest of the peritoneal cavity being walled off with gauze. If the bowel remains healthy it can be released; if sloughing occurs an artificial anus will have formed and can be closed later.

When there has been extravasation of the intestinal contents the abdominal cavity should be thoroughly washed out with a warm normal salt solution, drainage applied, the omentum drawn down and the incision closed. If much blood has been lost infusion of the saline solution may be practiced with good results.

As the time consumed in operating has an important bearing upon the prognosis all operative procedures must be conducted with as great rapidity as is consistent with safety. The chief dangers that may have

to be combated are shock and septic infection of the peritoneum. The patient must be kept quiet, the bodily heat maintained, hypodermic injections of strychnia and stimulating enemata administered, and nourishment given for the first few days by the rectum. Should tympanites occur a saline cathartic must be prescribed, without reference to the time that has elapsed since the operation.

Puncture wounds of the abdomen are less likely to involve the intestine than gunshot wounds, especially if it is in an empty state, as it is more likely to slip away from before the cutting instrument.

The treatment is the same as in gunshot wounds.

Contused or lacerated wounds of the intestine usually follow a blow or other violence upon the abdomen. The more prominent symptoms are severe pain, collapse, nausea and vomiting, retention of urine, etc.

Where the abdomen has sustained a severe blow, or has been injured by a fall, or by a wheel passing over it, it is important to ascertain as early as possible whether the intestine has been ruptured. Rectal insufflation of hydrogen gas must be practiced, when, if the bowel is intact, the distension will proceed uniformly upward; but if it has been ruptured general tympanites will occur, and upon percussion the dullness over the region of the liver will have disappeared and in its stead tympanitic resonance will be found.

If the results of distension indicate that there is a solution of continuity of bowel tissue the abdomen must be opened at once by a median incision, any extravasated blood or intestinal contents sponged or washed out, hemorrhage, if it exists, stopped, and the injury to the gut examined. Unfortunately, the appearance of the tissues furnishes but little idea of the extent of damage done; usually the bowel and mesentery have sustained greater injury than is at first apparent, and for this reason suturing the rent is rarely practicable. The diseased tissue should be removed and the continuity of the intestinal canal restored by circular enterorrhaphy or lateral anastomosis. The surgeon must decide, under any particular circumstances, what is best to be done. If the gut has been ruptured at more than one place, though a fatal result almost necessarily follows, a double resection may be done. The abdominal cavity must then be thoroughly washed out and dried by sponging, and drainage instituted.

The after-treatment of these cases requires the greatest care and attention. Shock, which is usually an accompanying symptom, must be treated by the hypodermic administration of remedies to restore the heart's action, as strychnia, digitalis, and, if the pain is severe, morphine may be given. Artificial heat must be applied about the body to restore the natural warmth. Neither drink nor food should be given by the mouth for twenty-four to thirty-six hours; if thirst is great it may be relieved by warm water enemata. If urine is not passed the bladder must be evacuated in from fourteen to sixteen hours, but if a disposition to urinate or a feeling of discomfort is felt it may be done at any time. When vomiting ceases, if present, the reactionary symptoms may be met by such remedies as aconite, arnica, arsenicum, belladonna, bryonia, rhus tox., etc. At the expiration of twenty-four to forty-eight hours, if the condition will permit, food, such as beef juice, white of an egg stirred up in water, rice or barley water, may be given in small quantities at short intervals.

CHAPTER XIV.

FECAL FISTULÆ AND ARTIFICIAL ANUS.

Etiology.—A fecal fistula is a communication between the intestinal cavity and the external surface of the body or some internal hollow organ, through which intestinal gases, fluids or fecal matter escapes. Of intestinal fistulæ those communicating with the bladder, uterus, vagina, or some other part of the gut, are the most frequent. If the location of the fistula is above the ileo-cecal valve the discharges will consist almost, if not entirely, of gas and fluids; and if below the ileo-cecal valve fecal matter will also escape. Artificial anus is usually classed as a fecal fistula, but it seems proper that a distinction should be made. In artificial anus there is a more or less complete interruption of the fecal current, the result of a septum or flexion which has been formed by the opposite intestinal wall and which serves to direct the intestinal contents toward the outlet; while in fecal fistula proper the intestinal current is not entirely arrested and only a part of the intestinal contents pass out.

Intestinal fistulæ are produced principally by gunshot and stab wounds, contused or lacerated wounds from external violence expended upon the abdomen, wounds unintentionally made during intra-abdominal operations, typhoid, tubercular or other ulcerative conditions, appendicitis, foreign bodies in the intestinal canal, strangulation of the bowel and abdominal and pelvic abscesses—the two last-named being the most frequent causes. They open usually into the rectum, bladder and intestine internally, and in the groin or the lumbar region externally. In the other conditions mentioned as causes the wounds are usually small, or only a small part of the bowel is injured. A plastic inflammation is set up, and before perforation of the intestine or extravasation of its contents has occurred the bowel wall around the seat of the lesion becomes adherent to the abdominal parietes, or to some adjacent hollow organ, or an abscess is formed and establishes a communication between the lumen of the gut and some neighboring organ or the surface of the body.

Other causes of intestinal fistulæ are malignant tumors, actinomycosis, drainage tubes, sutures and ligatures.

Malignant tumors produce intestinal fistulæ by direct invasion of the intestinal wall, or by obstructing the lumen of the gut so that distension and ulceration of the proximal side with perforation result. Actinomycosis sometimes causes diffuse abscesses that lead to the formation of an intestinal fistula. A ligature embracing more or less of the intestinal tissues, should suppuration occur along its tract, may cause perforation of the bowel. In closing abdominal incisions after intra-abdominal operations a loop of intestine may be included in the suture and strangulation occur from compression against the abdominal wall when the sutures are tied; or a part of the circumference of the bowel may be included and the ligature cut its way through it. In either event an intestinal fistula is likely to occur. Drainage tubes sometimes cause

intestinal fistulæ when their long continued use is necessary, by the pressure they exert upon the intestines.

Anatomically, fecal fistulæ may be divided into two classes:—

First. The intestinal opening is some distance from the outlet and is connected with it by a fistulous track.

Second. The intestinal wall is directly adherent to the abdominal parietes or some adjacent organ at a point opposite the outlet, and the margins of the bowel-wall line the margins of the outlet, the communicating tract being lined throughout by the mucous membrane of the intestine. In these forms the lumen of the gut remains normal in size and direction, and the fecal circulation is not interfered with, the canal being straight or but slightly deviating from the normal course.

Artificial anus, when not made by the surgeon for the relief of some intestinal lesion, is produced by the same causes as intestinal fistulæ. The interruption of the fecal circulation may be due to an obstruction of the lumen of the gut below the fistulous opening, to an acute flexion of the bowel, or to the formation of a spur at a point opposite to the abdominal opening. These conditions not only interrupt the flow of intestinal contents but serve to direct it toward the outlet.

Treatment.—A careful investigation of the history of the case must be made, and if possible a correct understanding of the causes that produced the fistula arrived at before a correct line of treatment can be instituted. The location and size of the opening in the gut, its condition at this point, and the length of the fistulous tract are matters for consideration.

Fecal fistulæ sometimes heal spontaneously, but this can only occur when the producing cause is benign and temporary in character, the bowel opening is small, and adhesions have formed between the gut and the abdominal parietes, the fistulous tract is not lined with mucous membrane, and there exists no spur or flexion to interfere with the free passage of the intestinal contents. The cure in these cases can be aided by thoroughly cleansing the bowels with sulphate of magnesia, keeping the patient at rest in bed, allowing liquid diet only, keeping the fistulous tract in as nearly an aseptic condition as possible and covered by antiseptic compresses of gauze to prevent infection from without.

When the fistula is the result of a malignant or infectious disease spontaneous healing is out of the question, and treatment looking to the removal of the primary cause must be instituted. If successful the fistula may close spontaneously, or become amenable to operative treatment. In fistula caused by malignant disease the propriety of establishing an artificial anus on the proximal side may come up for consideration when the tissues have become so extensively invaded as to render a radical operation unadvisable. When, owing to the location of the intestinal opening, no satisfactory information can be had of the exact conditions existing, and there is no urgent indication of operative measures, conservative treatment should be adopted with a view of determining whether or not the forces of nature will effect a cure. When the fistulous tract is accessible throughout and when it is lined with mucous membrane cauterization with nitrate of silver, or the Pacquelin cautery, is of value in hastening its closure. The cauterization removes and destroys the infected granulations, removes the mucous membrane and

renders the tract aseptic and favorable to the formation of healthy granulation tissue. The same treatment is applicable in selected cases of intestinal fistulæ. When using the cautery the exact length of the tract to be cauterized must be ascertained in order that injury to the bowel tissue may be avoided. In cases complicated by abscess efficient drainage is demanded, and frequently yields good results. In cases where no flexion, spur or other obstruction to the fecal circulation exists, the opening in the bowel is small and is adherent to the abdominal parietes, and the fistulous tract of easy access, closure may be effected by excising the entire fistulous tract, removing all scar tissue and the mucous membrane lining the margins of the opening, and suturing the wound.

The mucous membrane is first united by fine silk suture taken close together, then all the tissues except the mucous membrane and the skin are brought in opposition by a row of sheep-gut sutures, and finally the skin is coapted with silk. An antiseptic dressing is applied. No food by the stomach is allowed for the first few days.

When the intestinal opening is distant from the abdominal opening or a flexion, spur or other impediment to the fecal circulation exists, this method is inapplicable. In such cases the abdomen must be opened and such operative procedure instituted as will best meet the requirements in each particular case.

Resection of the gut and circular enterorrhaphy are attended with such a high rate of mortality that they should be reserved for exceptional cases to which safer procedures are inapplicable.

Intestinal anastomosis between the bowel above and below is a preferable method, when it can be done. By this method the perforated portion of bowel is removed from the fecal current, and many of the distressing features incident to the passage of intestinal contents through the fistulous tract relieved.

When the gut is adherent to the abdominal parietes and a spur exists, the opening in the intestine should be closed by sutures taken transversely and close enough together to prevent the escape of the contents of the bowel, and embracing all the coats. Incisions are then made around the borders of the abdominal opening, taking in all scar tissue, the peritoneal cavity opened, and the bowel detached. The skin and scar tissue are then carefully dissected away and the sutures for burying the ones already introduced are taken. The bowel is then thoroughly cleansed and the abdominal wound closed.

CHAPTER XV.

DISEASES AND INJURIES OF THE OMENTUM AND MESENTERY.

Diseases and Injuries of the Omentum.—Owing to the anatomical structure and relation of the omentum it is, to a greater or less extent, implicated in all the diseases and injuries that affect the peritoneum and abdominal viscera. In all the inflammatory diseases of these organs it is more or less involved, becomes congested, thickened and adherent, and in this way is often a medium of protection and security against diseases and conditions that would otherwise prove rapidly fatal. Its adhesions to surrounding structures often walls in, as it were, the general abdominal cavity by its rapid inflammatory attachment to underlying structures. In this way visceral wounds are sometimes sealed up, extravasations limited and suppurative areas circumscribed. On the other hand it sooner or later becomes involved in malignant, tubercular and other diseases, and aids in their dissemination. Carcinoma primarily does not affect this membrane. The pre-existing gland tissue that bears such a close relation to the production of this form of neoplasm does not exist here. When the omentum is affected by this disease it is through infiltration from the viscera to which it becomes attached, or by extension through the lymph glands. The omentum sometimes becomes the initial seat of sarcomata. These growths, when they develop here, may attain considerable size before adhesions to adjacent structures take place. Consequently they are more or less movable and can be readily detected through the abdominal walls when these are not thickened by deposits of overlying fat. When recognized early they may be removed by a laparotomy.

Dermoid cysts having their origin in the ovary may form firm attachments to the omentum. When these tumors are connected by a long pedicle they may take on an axial rotation, the pedicle becoming slowly strangulated, the tumor losing its original attachment, its life being preserved solely by its omental relation. In this way they sometimes become almost solely tumors of the omentum. Solitary hydatid cysts may develop in the omentum, and disseminated cysts of this character, springing from a rupture of a mother cyst of the liver, are not infrequent. In such cases they are usually of extensive distribution. The omentum is liable to be injured in all instances in which traumatism is inflicted on any of the abdominal viscera. It is often wounded by cutting instruments, or by a missile that penetrates the abdominal walls. In an extensive wound it may protrude through the opening in a large mass. In dealing with the omentum in a surgical way it should be in the most delicate manner, and with every antiseptic and aseptic precaution. If protruding, it must be carefully cleansed with a mild alkaline solution and returned. If lacerated or congested it should be ligated in small sections,

by fine sheep-gut, and removed; but little tension can be put upon these ligatures lest they cut through its very delicate texture and consequent bleeding then follow. In cases where it becomes necessary to remove a large mass of omentum it must not be ligated in mass, but spread out and dealt with in small sections. Cysts may be removed from it by first ligating and then cutting them away.

Tumors and Cysts of the Mesentery.—Sub-serous lipomata sometimes develop in the mesentery. They occasionally develop to an enormous extent, are removed with difficulty, and the procedure always endangers the integrity of the overlying or attached intestine. Cysts sometimes develop between opposing peritoneal layers of mesentery, and may contain a serous or a sero-sanguineous fluid. Their removal is not only difficult but is liable to be followed both by hemorrhages and intestinal necrosis, the obliteration of the mesenteric vessels producing ischemia and consequent infarction of the intestinal structures. They should be dealt with by attaching the cyst wall to the parietal wound, and after firm adhesions have taken place they should be opened and drained.

Occlusion of the Mesenteric Vessels.—Gangrene of the intestines from this cause is of rare occurrence, yet it is of sufficient frequency and importance to merit the attention of operators who engage in abdominal surgery. There is but little literature upon the subject, and but few, if any, text-books mention the matter at all; and when it is discussed it is in a way to discourage operative treatment. But since the adoption of modern surgical measures and the favorable results now obtained in intestinal operations this disease, like other obscure troubles, the relief of which were formerly considered beyond the pale of surgical possibilities, is worthy of the attention of all operators.

The trouble usually develops in patients affected with heart lesions, atheromatous degeneration of the arteries or cirrhosis of the liver, cancer, dysentery, etc. Pilliet theorizes that a bacterial inflammation of the intestines may start up a thrombus in the mesenteric veins.

The occlusion occurs either in the artery or vein; in either case the circulatory disturbance may be sufficiently great to imperil the integrity of the bowel, causing infarction and consequent sloughing or gangrene. There may be great variations in the extent and character of the disintegrating pathological lesion of the bowel. In some cases there may be simply a high degree of congestion, or an ulceration, while in others necrosis of the bowel to a greater or less extent exists. In one case that came under the observation of the author a laparotomy revealed an area of infarction in which the ileum was more or less congested and gangrenous for a distance of eight feet; no other pathological lesions existed, the bowel shading off into healthy structure in either direction. The small intestine is the usual seat of the trouble, though instances have been reported in which the colon was the part affected.

SYMPTOMS. Neither the subjective nor objective symptoms of occlusion of the mesenteric vessels are distinctive; in fact, they very much resemble those that attend an attack of intussusception. Pain is an early and constant attendant of the disease. At first it is dull and aching, and is referred to the epigastric region; but later though constant it takes on paroxysmal exacerbations. After varied periods of time nausea and vomiting come on, the rejected matter being first the contents of the

stomach, in a more or less digested state, but ultimately becoming bitter, acrid and bilious, and, it may be, fecal. Diarrhea is usually present, and is the most characteristic indication; while the other symptoms point more strongly to obstruction, this one is more constant, copious and bloody than from any of the causes producing obstruction. The evacuations, after the first, are dark, intermixed with blood and offensive; at times quantities of blood may pass. There are usually tenesmus and straining. The temperature is at first somewhat elevated; as gangrene and consequent septic peritonitis ensue it may become sub-normal.

The presence of a valvular disease of the heart, or other lesions that are liable to produce embolism, or thrombosis, may throw light upon the diagnosis.

The prognosis is unfavorable.

TREATMENT. While the general condition of the patient merits attention from a therapeutical standpoint the greatest hope rests in operative procedures. The abdomen should be opened and a resection of the diseased bowel performed.

Staphisagria will be found an excellent remedy in the abdominal shock that follows injuries of the intestines or mesentery, and also after abdominal operations. Arnica and hypericum are also excellent remedies in these states, but the first named remedy will often suffice to restore the equilibrium of the nervous system, and should not be overlooked in abdominal injuries and operations.

Camphor, veratrum album, and carbo vegetabilis are remedies of value in shock and collapse. Carbo vegetabilis is more useful for secondary collapse, camphor and veratrum for primary collapse and exhaustion. If choleraic diarrhea comes on veratrum or arsenicum will be most useful. The characteristic apprehension and restlessness of the latter remedy should be borne in mind, as also its peculiar thirst and dyspnea. Camphora is indicated when the patient is collapsed and cold, without sweat, particularly, veratrum having preference when the patient is bathed with cold perspiration. Phosphorus may be demanded if there is severe syncope and dyspnea, with the diarrhea of relaxation. Nux vomica, chamomilla colocynthis, magnesia phosphorica or belladonna may be required for severe abdominal pain, while ferrum phosphoricum or aconitum may have to be given for threatening inflammatory symptoms.

CHAPTER XVI.

OPERATIONS FOR DISEASES AND INJURIES OF THE INTESTINES.

Preparations for Operating.—In order to attain the greatest degree of success in abdominal surgery, and in all other kinds as well, it is imperative that every feature of antiseptic methods be carefully adhered to and that every detail of operative technique be systematically carried out. It is the painstaking, methodical surgeon, and not the rapid, brilliant and flourishing operator who obtains superior results. If possible, it is important that the patient should come under the observation of the surgeon at least one or two days before the operation, in order, first, that a correct understanding of his physical condition may be obtained; secondly, that his diet may be restricted and regulated, his secretory functions improved and the necessary rest given to his body and mind; thirdly, that the field of operation may be rendered as nearly aseptic as possible. He should be placed upon nutritious but easily digested food, such as will not unduly tax the digestive powers, and leave but little residual matter in the intestines and not generate gas. The day before the operation a brisk saline purge should be administered—one tablespoonful of Rochelle salts given in a tumbler of hot water will answer well; however, if this does not act in from four to six hours half the quantity should be repeated. He should have a general bath, if his strength will permit it, in the morning and evening of that day, and, if a woman, a vaginal douche must also be given. The field of operation is then scrubbed thoroughly with soap and water, and at the same time the abdomen shaven, particularly the pubes. After being shaved and scrubbed it is bathed with ether and then washed with a solution of bichloride of mercury, 1 to 1,000; a poultice of green soap is now applied over the parts and allowed to remain one hour. It is then removed by scrubbing with brush and warm water, after which a compress wrung out of a warm bichloride solution, 1 to 2,000, is applied and sustained in position by a bandage.

The morning of the operation he is given an enema of

Rochelle salts.....	℥ j.
Turpentine.....	f ʒ ij.
Glycerine.....	
Water.....	a a f ʒ jv.

M. S.—To be given at one injection.

This will cause the bowels to be evacuated and remove the gases that may be retained therein; he is again bathed, the compress reapplied, he is clad in clean linen and a pair of long warm stockings put upon his feet; he should then be kept quiet and comfortable until the hour for operating. After the patient is anesthetized and is placed upon the table the field of

operation is again washed with soap and warm sterilized water, then irrigated with a bichloride solution 1 to 2,000, then again irrigated with the normal salt solution. The body about the operative field must then be swathed in towels previously sterilized by boiling and wringing out of a three per cent. carbolic acid solution. If the case is one of accident or emergency, in which postponement for preparatory purposes cannot be made, the necessary process of sterilization must be done at the time of operating. The parts should be lathered and shaven, then scrubbed with soap and brush and washed until cleaned, rinsed with ether, irrigated with a bichloride solution 1 to 1,000, then again with the normal salt solution.

When the moment for beginning the operation arrives no further use is made of antiseptic substances; nothing whatever but sterilized water and a normal salt solution are used about the operation.

The instruments must also be subjected to the same rigid process of sterilization. This may be done by placing them in a steam sterilizer at a temperature of not less than 250 degrees for thirty minutes, or they may be placed in a covered vessel containing a one per cent. solution of carbonate of soda and boiled for fifteen minutes. They may then be lifted out and placed in trays containing warm sterilized water, the trays having previously been sterilized with strong antiseptic solutions, 1 to 500 bichloride of mercury, then thoroughly rinsed with sterilized water. Silk sutures must be rendered aseptic by thorough boiling and then placing them in absolute alcohol. Unless the surgeon is prepared and well versed in the sterilization of gut ligatures and gauzes he had better use those furnished by reliable manufacturers.

The instruments must be placed on tables in easy reach, and an extra tray filled with three per cent. carbolic solution made with sterilized water should be placed alongside of those holding them. All instruments used must be cleansed and washed in this, and then returned to the tray from which they were taken. Three one-gallon water bags, one filled with 1 to 2000 bichloride solution, one with normal salt solution prepared by adding six drachms to a gallon of water, boiled, strained, allowed to cool, and one of sterilized boiled water must be hung in convenient position. Two vessels should be arranged for the sponges, one in which to wash them when soiled and the other to receive them after they are washed. Both the surgeon and assistants should have in easy reach a basin of sterilized water in which to rinse the hands at any time they may become soiled or unduly covered with blood.

The table, one that can be changed to the Trendelenberg position, must be covered with a clean blanket, over which is spread a rubber cloth, and over this a clean sheet. If a Kelley's pad is at hand it will answer in place of the rubber sheet. It is well in most cases that the table be somewhat tilted to one side, that drainage of the fluids used into a tub below may be facilitated.

The condition and safety of the patient are always worthy of the greatest consideration. He must be placed in the most comfortable attitude, one that will not strain his muscles, consistent with the necessities of the operation; all exposed parts of the body should be covered and protected with a light blanket. While the anesthetic must never be

carried to the danger line it should be sufficiently profound to insure absolute quiet and prevent vomiting.

PREPARATION OF THE SURGEON AND HIS ASSISTANTS. Everyone who essays to do surgery should be by nature careful, methodical and cleanly. He should bathe his body regularly, wear clean clothes, keep his finger nails trimmed, and observe decent habits. Before entering the operating room, and especially before handling any of the instruments or appliances used in the operation, he should remove his coat, vest and cuffs, and roll his sleeves above his elbows. Then with soap and brush he must thoroughly scrub his hands and arms, frequently changing the water, for at least ten minutes. He then immerses them in a bichloride solution of 1 to 1000 for two minutes, after which they are rinsed in sterilized water. He now dons a clean gown that has been previously sterilized by boiling, which covers in all his clothing and reaches to his feet. He then again washes his hands in the bichloride solution and rinses as before. If at any time during the preparation for the operation or its performance either the surgeon or the assistants touch or handle an object not in an aseptic state there must be an immediate reablution of hands.

A method that receives the endorsement of some of the very best surgeons, and one that is especially adapted to instances in which the operator has recently been in contact with infectious material or diseases, is the use of permanganate of potassium and oxalic acid solutions, as follows: The hands and fore-arms, being thoroughly scrubbed with soap and warm water for several minutes, are immersed for about one minute in a saturated solution of permanganate of potassium, which is well rubbed into the skin. The hands are then bleached in a saturated solution of oxalic acid. The oxalic acid solution is then washed off with distilled boiled water, and the hands finally immersed in a solution of bichloride of mercury 1-200 for about one minute, and then rinsed.

Opening the Abdomen.—After the surgeon has decided upon the point of opening and the direction in which it is to be made, he should proceed in the most deliberate and calculating manner in its execution. The first stroke of the knife divides the skin and superficial fascia and underlying fat, exposing, if in the tendinous raphe (*linea alba*) the dense fascia, or if over the muscular structures, the more delicate muscular fascia. In the former case the fibrous layer is rapidly incised down to the peritoneum. In the latter the muscular tissues should be exposed by gently incising the fascia, and if muscular fibres run parallel to the incision they should be separated with either the finger or handle of the scalpel; the bundles of muscular tissue running crosswise or diagonally must, of course, be severed by successive cuts with the knife. When the peritoneum is reached a pause should be made and all bleeding points secured with catch-forceps; if the deep epigastric or a branch of the circumflex iliac is severed it must be ligated with fine sheep-gut. When the bleeding has ceased the peritoneum is caught with two pairs of forceps drawn forward and nicked between them, and divided along the palmar surface of the index finger with a pair of angular scissors. It is important that the abdominal wound should be of sufficient proportions to admit of easy manipulations when executing the work upon the intestines. It has been thoroughly demonstrated that the length of the

incision has but little to do with the prognosis, while want of space through which to operate may be productive of irreparable injury.

Closing the Abdominal Wound.—The cardinal principles governing the sewing up of the parietal incision is the accurate apposition of like structures. This can be best affected by using three rows of sutures. The first, of medium sized sheep-gut, unites the peritoneum and the transversalis fascia; the second, of silk, or silk worm gut—the latter is preferable—which brings together all the superstructures, is interrupted. These are applied about half an inch apart and are introduced by entering the needle in the skin one-third of an inch from the border of the wound on one side and passing it downward, outward and inward in a curved direction, piercing all the structures down to the peritoneum (but not puncturing it), bringing it out below; it is then carried across the wound to the opposite side, re-entered and passed upward in a like manner, and brought out through the skin at the same distance from the edge of the incision and snugly but not tightly tied. When these sutures are all introduced the skin is accurately coapted by an additional row of small sheep-gut. In some cases where much abdominal fat is present it may be necessary to unite the strong fascia overlying the recti muscles by an additional line of buried sutures.

Dressing.—After the wound is closed it is irrigated and dried, plentifully dusted with iodoform and covered with an abundant supply of sterilized gauze, which is protected with a layer of oiled silk, held in position by adhesive strips, or a bandage. If all goes well the dressing need not be disturbed for a week, when it may be removed and the stitches taken out.

Suturing the Intestine.—The variety of sutures that have been devised for uniting the margins of a divided or injured bowel are numerous; some are inefficient, others are complicated, while a few are simple and effective. No complicated method of suturing should be adopted when performing operations upon the intestines. Simplicity here, like

in many other things, is to be commended; therefore, few of the methods are worthy of consideration. In abdominal operations the interrupted, continued, Lembert, and the Czerney-Lembert fill every requirement.

The interrupted suture (Fig. 600) is more especially adapted to the closing of wounds of the abdomen. The needle is introduced from one-third to one-half an inch from the margin of the wound, passed downward to the required distance, return-

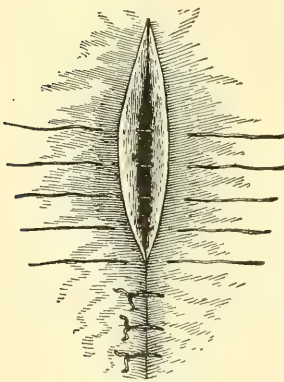


Fig. 600.
Interrupted Suture.

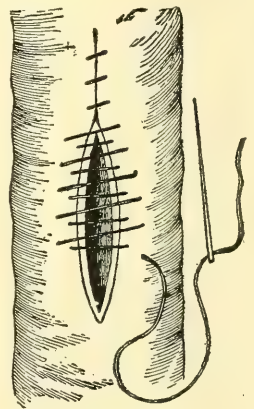


Fig. 601.
Continuous Suture.

ed from below on the opposite side of the wound, and brought through the skin at the same distance from its margin; it is then drawn sufficiently snug to accurately coapt the two edges and tied. If too much tension is

put upon them the included tissue will be more or less strangulated and small abscesses may form.

The continuous suture (Fig. 601) may be used in any of the operations done on the intestines. It is easy and rapid of introduction and is usually efficient. It is formed, when used in intestinal operations, by introducing the needle one-eighth of an inch from the edge of the wound, picking up the serous and muscular coats of the intestinal wall, passed transversely to near the margin, brought out and carried over the wound to a corresponding distance, re-entered and made to include a similar fold. The process is continued without interruption until the opening is closed, there being eight stitches to the inch; by this process the margins of the wound are inverted and the two strips of serous membrane brought into coaptation.

THE LEMBERT SUTURE. This is probably the most universally approved suture in use. It is a form of interrupted suture. The needle is passed in the same manner as the continued suture, but each stitch is tied separately (Fig. 602.)

CZERNEY'S SUTURE. This is a Lembert's suture with an inner row of interrupted sutures which unites the mucous membrane (Fig. 603); the

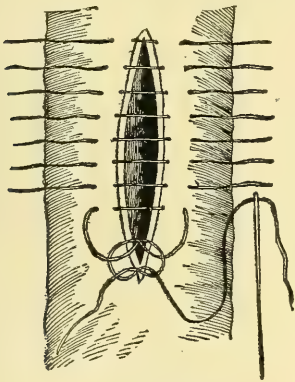


Fig. 602.
Lembert Suture.

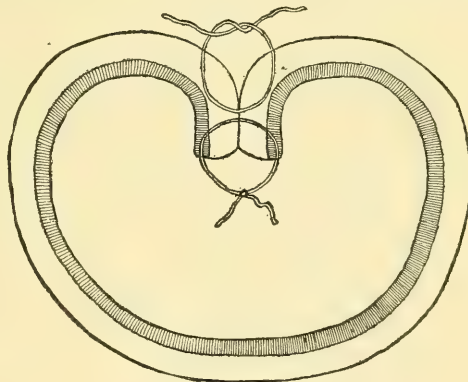


Fig. 603.
Czerney-Lembert Suture.

knots of the inner row are turned inward. The needles used may be of the straight or curved variety, to suit the experience or convenience of the operator. A good form of needle is the ordinary sewing needle, small, slender and about one and one-fourth inches in length.

SUTURES. The form of sutures mostly indorsed by the profession in intestinal operations is fine silk. It is strong, of even texture and close fibre, and can be made thoroughly aseptic. Fine sheep-gut is employed by many, and by those who use it is considered very superior; while it is not so smooth as the silk, and, it is claimed, cannot be rendered perfectly aseptic, it is absorbable and does not remain in the structures as a foreign body that is at sometime liable to prove a source of irritation, though it remains intact sufficiently long to insure firm adhesive union of the parts.

Drainage.—The question of drainage is one that must be settled in the mind of the surgeon after each individual operation. Ordinarily when the work has been well done and an aseptic condition of the

abdominal cavity is assured drainage is not called for. But if serious injuries have been sustained by the viscera or the peritoneum that may result in a large exudation of blood or serum, if septic matter has been poured out into the peritoneal cavity, or if a doubt exists in the mind of the operator as to the security of the gut against leakage, drainage becomes a necessity.

GLASS-TUBE DRAINAGE. Some diversity of opinion exists as to the best methods of accomplishing drainage. Glass drainage tubes seem to have the preference with most surgeons, and in the care of expert and conscientious nurses afford an ideal and safe method; but in the hands of the ignorant and careless the glass tube is hazardous. For a time it accomplishes its object well, but it requires careful and unremitting attention. The object of the tube is to keep the abdominal cavity perfectly free from either serous or bloody oozing. To do this it is necessary that the tube should be evacuated with a long-nozzled syringe. In some cases it must be cleansed every twenty to thirty minutes, and when the discharge grows less profuse must be emptied every hour to two hours. The mouth of the tube should be frequently washed with a bichloride solution and the abdominal dressings protected by a piece of rubber-dam, through which the neck of the tube projects; this, in turn, should be scrupulously cleansed. It is quite necessary that the tube be rotated every few hours lest portions of omentum or intestine be insinuated through the openings or engage in the bottom end. It is imperative that the person who attends to the tubes should preserve an aseptic condition. It matters not how often the tube is handled the act should always be preceded by a thorough washing of the hands.

Very efficient drainage is accomplished by capillary attraction and, therefore, it often suffices to carefully fill the tube with gauze and cover its mouth with a plentiful supply of moist sterilized gauze to take up the fluid withdrawn. This requires frequent changing. The tube should be long enough to reach to the bottom of the space which it is desired to drain, usually about five or six inches. The presence of the drain always excites more or less irritation and consequent adhesion, therefore it soon becomes sealed in by inflammatory products and visceral attachments and is then a useless affair. It should be removed as soon as the discharge grows small and becomes of a yellowish, serous nature, which is usually in from twenty-four to forty-eight hours.

GAUZE DRAINAGE. A gauze drain is oftentimes the most efficient method of abstracting fluid from the abdominal cavity. It acts entirely through capillary attraction, drains continuously and requires no attention. It is especially applicable where it is desired to isolate injured viscera and to compress bleeding surfaces. Gauze can be packed deep into the pelvic cavity, can wall off the intestines and be made to convey fluids along tortuous courses or over long areas. It may be applied in loose rolls, packed in folds, or used in the form of a bag that is filled with small strips of gauze. This may be made by taking a piece of gauze fourteen inches square, to the centre of which is attached a piece of silk ligature, and forming it into a sort of a bag, the closed end of which is placed deep in the cavity to be drained. It is then loosely filled with strips of gauze, the free end of the bag and strips protruding through the parietal opening, the ligature emerging in the centre.

When it is desired to remove the gauze, at the expiration of forty-eight to seventy-two hours, the strips are first withdrawn and then, by gently pulling up the cord, the bag is gradually inverted and removed.

An objection that can be raised against the gauze dressing is that it is at times painful and difficult to extract. The omentum, intestines and abdominal tissues sometimes adhere firmly to it.

CHAPTER XVII.

ENTERECTOMY.

Definitive and Histological—This term signifies an incision of part of the intestine. It is resorted to for the purpose of removing a portion of injured or diseased gut in order that the integrity of the canal may be restored or its continuity re-established. When performed upon the colon the operation is designated colectomy. The history of the operation dates back to the early days of surgical literature. Among the first successful cases recorded in modern times are those of Ramdohr, in 1727, Arnaud, in 1732, and Reybard, in 1843. The case of Beebe, of Chicago, may be classed as a notable instance among the early operations. In 1870 he successfully removed four feet and ten inches of the ileum, establishing a fistulous opening through the parietal walls in a female patient suffering from strangulated inguinal hernia. A few weeks afterward he performed anastomosis, re-establishing the fecal circulation by means of a mechanical device, and closed the abdominal fistula. The patient, who was four months pregnant, carried the fetus to full term.

Within the last few years the operation has been frequently and successfully performed by many surgeons and has become an established surgical procedure. Portions of the bowel ranging in length from a few inches to five or six feet have been successfully removed. Koeberle excised more than six feet of the small intestine and the patient recovered. The mortality after the operation is large. In operations upon the small intestine it ranges from thirteen to seventy-five per cent. while in resections of the large bowel it is even greater. The operation of excision and suturing of the bowel is designated enterorrhaphy.

Circular Enterorrhaphy, or End-to-End Coaptation.—OPERATION. After rendering the field of operation thoroughly aseptic the abdomen is opened and the seat of injury or disease located. If extravasation into the abdomen has taken place this must receive the first care of the surgeon. The effused material should be removed and the peritoneal cavity cleansed with sterilized water or the normal salt solution. The loop of intestine demanding attention is then isolated and drawn well out of the parietal incision. Its release may require great care and patience; in fact, at times it is a perplexing and tedious task. If the lesion is a simple perforation and inflammatory attachments are absent the delivery is accomplished at once but in cases of fecal fistula, in malignant diseases and some forms of chronic obstruction the liberation and withdrawal of the loop is a problem that is not always easy to solve.

When the condition is such that isolation of the affected portion of the bowel is impossible it may become necessary to abandon the idea of resection and resort either to lateral anastomosis or the establishment of an artificial anus. If extensive gangrene is present it may be proper to abstain from further operative procedure and close the abdomen at

once. When the bowel has been freed from its attachments it is withdrawn from the pelvic cavity, placed upon a warm sterilized towel, and then carefully examined and healthy gut above and below the diseased area brought into view. The mesentery must also be inspected. After

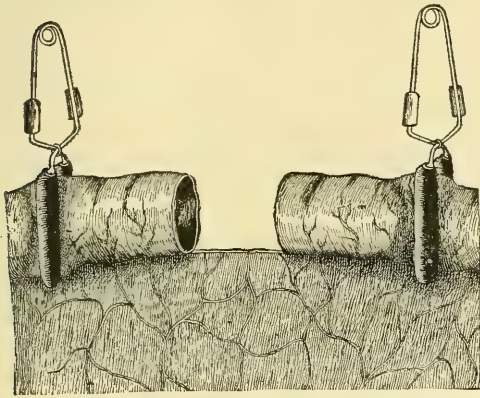


Fig. 604.—Clamps in Situ.

the surgeon has satisfied himself as to the condition present and as to the procedure necessary for its correction, the abdominal wound is packed around the exposed portion of the gut with strips of gauze, and a clamp or temporary ligature is placed above and below the area to be excised (Fig. 604). The upper one should be applied first and the segment of bowel emptied by gently stripping it downward between the thumb and finger, after which the lower one is placed in position.

However, if the bowel is greatly distended with gases or fecal matter it must be evacuated by making an opening in the loop, the contents being conducted into a pus basis in such a way as not to soil the wound. If time is not too important it is also well to flush or irrigate the bowel. The clamps are then applied, the isolated portion of the intestine cleansed by wiping and irrigating, and the packings and surroundings re-adjusted, or changed if necessary, so as to insure perfect asepsis.

Excision is accomplished with straight scissors, the section being made from the free border of the mesentery at right angles to the gut. In approaching the mesentery care must be observed lest it be needlessly sacrificed and a portion of the gut deprived of its vascular supply. It must be borne in mind that the mesenteric walls begin to diverge one-half inch or more before reaching the intestine, and that this triangular interspace is filled with the vessels and nerves that supply the bowel, connective tissue and fat. Unless this fact be intelligently considered the sutures here may be imperfectly applied and a leakage into the intraserosus space, with its consequent evil results, may follow.

The mesentery is next severed within the bounds of healthy tissue and the bleeding points secured by deligation, or by means of a running suture or over-stitch of fine sheep-gut. The bleeding points having been secured, the mesenteric gap is closed by suturing, or if left full it is folded upon itself and secured by a row of stitches along its base, so as to bring into close apposition the layers of serous membrane. Great care must be observed that a precise adjustment of the mesenteric attachments at the intestino-mesenteric angles is accomplished, and, therefore, it is important that the line of suturing that unites the ends of the bowel be begun at this point. When the section of the gut is made it will be observed that the muscular and peritoneal layers will retract and leave the mucous membrane projecting to an appreciable degree. The margins of mucous membrane at either end of the gut are united by a row of fine silk sutures, the knot occupying a position on the mucous surface, known

as the Czerney suture (Fig. 603). After this the serous surfaces are coapted by a row of Lembert sutures (Fig. 602). After the two lines of sutures have been introduced an inspection of the work is made, and if any weak or suspicious points are observed the line should be reinforced by an additional suture. As before stated, the mesenteric border requires special

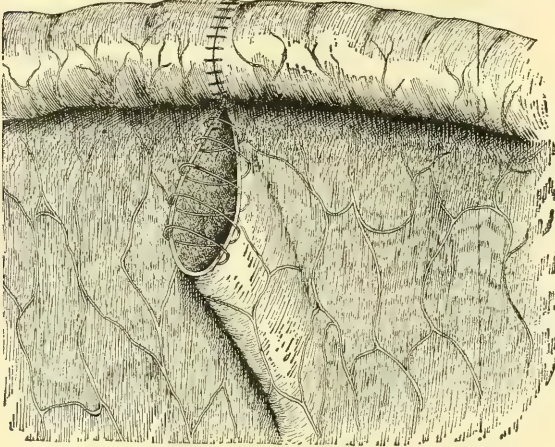


Fig. 605.—Circular Enterorrhaphy Completed.

attention, as it is always the most vulnerable point in the line. The bowel is now well cleansed and irrigated with a mild, non-irritating alkaline solution, the packing removed and the sutured loop dropped back into the abdomen and the parietal wound closed.

If the operation has been well and aseptically done drainage is not necessary. If a doubt exists as to the perfection of the work a pledget of gauze may be adjusted about the

line of sutures and brought out at the lower angle of the wound.

OMENTAL GRAFTS. Senn has recommended the use of omental grafts after suturing the intestine. He has carried out the experiment on brute animals and has found that a piece of omentum, after having been excised and placed in position and sustained by a few sutures, rapidly becomes adherent in its new position. All weak or doubtful points in the work, whether from contusion or imperfect suturing, should be reinforced by this method. A graft from one to two inches in width and long enough to encircle the bowel should be excised from the omentum, laid over the line of sutures and secured in place by two or three fine sheep-gut stitches passed through either end of the graft and the mesentery. This procedure may also be instituted to cover up visceral injuries, peritoneal denudations, or large pedicles after the removal of tumors or viscera.

AFTER-TREATMENT. The most careful attention should be given a patient who has undergone a surgical operation upon the intestines. Food by the mouth must be wholly interdicted for at least forty-eight hours, the strength being sustained in the meantime by rectal alimentation. Beef extracts and brandy, if stimulation is required, liquid beef-peptonoids, thin gruel, milk, and raw eggs may be used in this way, in quantities not to exceed a half pint every six to eight hours. The intense thirst should be alleviated by allowing frequent sips of hot water, or by the administration of small fragments of ice. When food is given it must be of the blandest and most digestible kind and repeated at short intervals in small quantities. After the third day, when union is reasonably assured, the bowels may be opened by a saline purge. One teaspoonful of Rochelle salts may be given every three hours until the result is accomplished. If the intestinal lesion is not situated low down, below the ileo-cecal valve, the medicine may be aided in its action by a stimulating enema. The occurrence of an evacuation of the bowels is usually

considered a favorable result, one that is always looked forward to by the surgeon with considerable anxiety. It removes at once a possible source of sepsis, relieves the tympanites and consequent intestinal paresis, restoring the tone and physiological peristalsis of the bowels. Opiates are always to be avoided when possible.

Lateral Implantation.—When there is much difference in the size of the lumen of the ends of the resected bowel, as in cases where the large bowel has to be united to the small one, or where one end is

greatly dilated, circular enterorrhaphy is not practicable and some other method of adjusting the injury must be adopted. Here lateral implantation, or lateral anastomosis, must be resorted to. The former operation has been highly commended by some able surgeons.

OPERATION. This is performed by inserting the proximal end into the distal part and securing it by sutures. The end of the distal portion of the gut is turned in and closed with Lembert sutures and the wall is incised opposite the mesentery in a longitudinal direction to the extent of one and a quarter to one and a half inches. This opening should be made about one inch from the closed end of the gut. The proximal end of the bowel is inserted into this and secured by sutures. The first row of Lembert sutures is carefully applied, so as to give perfect security against leakage, while the second row consists of an occasional inter-

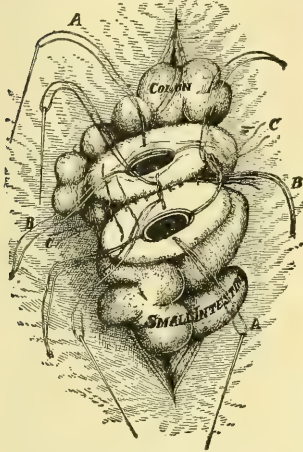


Fig. 606.

Intestinal Anastomosis with bone plates—AA, Lateral or fixation sutures; BB, end or apposition sutures; CC, posterior sutures.

rupted suture for sustaining or tension purposes.

The preparation of the patient and the general technique in no way differs from that for circular enterorrhaphy.

Intestinal Anastomosis.—**DEFINITION.** By intestinal anastomosis is meant the restoration of the continuity of the intestinal canal, when more or less obstructed, by establishing fistulous openings between the parts of the intestine above and below the seat of obstruction. The idea of thus effecting the restoration of the continuity of the obstructed intestinal canal originated with Maisonneuve. The operation sank into disuse, was revived at subsequent periods by other surgeons, but it remained for Senn to lift it out of the obscurity into which it had fallen and, by the success of his methods, to give it a first place among modern intestinal operations. The communication between the two parts of intestine is established by means of perforated decalcified bone or vegetable plates, sheep-gut or rubber rings.

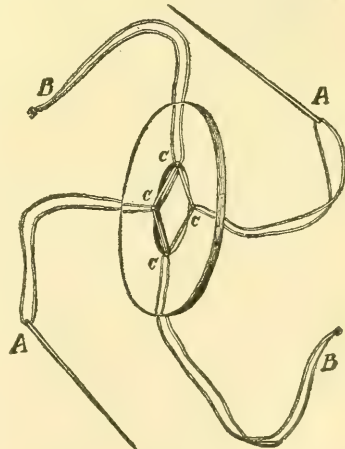


Fig. 607.

Senn's bone plate with sutures in position. AA, lateral or fixation sutures; BB, end or apposition sutures; CCCC, perforations in the plate.

SENN'S DISCS. Senn's discs are prepared as follows: Fine oval plates two and a half inches long, one inch wide and a quarter of an inch thick are sawn from the compact layer of the femur or tibia of an ox, and placed in a ten per cent. solution of hydrochloric acid (the solution being changed every twenty-four hours) until thoroughly decalcified. The acid is eliminated by placing them for a short time in a weak solution of caustic potash. An elliptical opening is then made in the centre. Four perforations for ligatures are also made at either end and in the middle of each side, close to the margins of the central opening. Sutures are then inserted by "threading two fine sewing needles, with aseptic silk twenty-four inches in length, which are tied together. The knots become ends of the end, or apposition, sutures (Fig. 608), while the middle of such threads holds the needle and becomes the terminal part of the lateral or fixation sutures. The fastening of the threads upon the plates is done by the lock-stitch, by another thread passing through the perforation in the

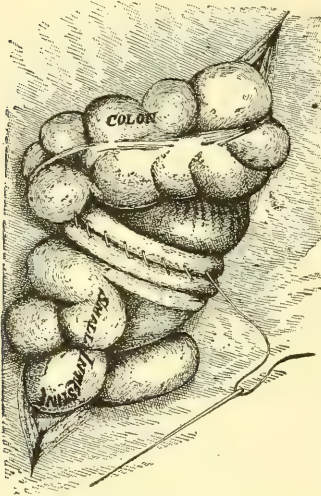


Fig. 608.
Intestinal anastomosis by bone plates.—Senn.

shape of a loop and fastened at the back." The plates are then immersed in a solution of equal parts of alcohol, glycerine and water until used, because if inserted into the alimentary canal when dry they may cause complications, owing to their tendency to swell.

VEGETABLE PLATES. Vegetable plates are formed from either raw turnips or potatoes, and answer the purpose admirably. With a broad knife thin slices, five millimetres thick, are cut from the tuber and shaped, perforated and threaded the same as described for the bone plates. They are then placed in a one or two per cent. solution of carbolic acid. This preserves and slightly hardens them.

ABBE'S SHEEP-GUT RINGS. Abbe, of New York, devised rings made of sheep-gut for the purpose of establishing anastomosis, to be used in the same manner as Senn's plates. He describes the preparation as follows: "A moderately heavy cat-gut is chosen, taken from alcohol or juniper oil, wound loosely on a test-tube and soaked in hot water. It soon kinks up and were it not on a tube could hardly be unravelled. After a while it is straightened out, allowed to untwist, wound again loosely, and soaked in hot water once more until it ceases to twist. It is then ready to make up into rings which will lie perfectly flat. Eight or ten turns over two pins stuck in a cork, two inches apart, will make a bundle somewhat smaller than a lead pencil. These may be tied at four places with fine silk, to secure the strands parallel while being wound round like a cable with a continuous piece of the same cat-gut. The end of the piece is secured by threading it into a Hagedorn needle and transfixing the whole bundle obliquely with it at the place of finishing. Thus there are no knots, and it is difficult to find the place of beginning. The ring is now a long oval, with an inside diameter of two inches, and in thickness smaller than a pencil. Six strong but small braided silk threads are now fixed to each ring, equidistant, on the face looking toward the

other ring, which is to be laid against it. No knots are used. A needle pierces the ring between the strands, carrying the thread, which is drawn through all but eight inches, and wound once and a half round, sinking between the encircling cat-gut, piercing the ring again, and cut off. The rings, which have now been water-soaked, are ready for use if needed for emergency; but if possible they should be kept a while in alcohol under pressure between two glass sides, the threads being curled up within the oval, and the sides being pressed as the glasses are tightly tied together. The ring thus becomes a long oval with parallel sides, and soon becomes harder and flattened on its faces. Moreover, it shrinks a trifle in alcohol, to swell again in situ and give additional security."

Abbe threads every piece of silk into its own needle before beginning to operate.

VAN LENNEP'S METHOD. Van Lennep, Philadelphia, has united the intestines end to end by means of rings made of ordinary drainage tubing. His method is said to answer the purpose admirably.

INDICATIONS. Anastomosis may be employed in the surgical management of many forms of intestinal disease and injury. It is appropriate when, from any cause, it is unadvisable or impossible to remove the bowel obstruction, as, also, in instances where it is found that it would be impossible to bring the severed ends of the gut together. It is said to be superior to resection in some cases of occlusion caused by either malignant or non-malignant neoplasms, especially where a prolonged operative procedure is contraindicated. In most examples of chronic intestinal obstruction, and even acute cases where the vitality of the parts has not been too greatly impaired, it is a superior method. It has been observed that in intussusception volvulus, etc., when the fecal circulation has been established by anastomosis, the strangulation of the vascular circulation is relieved and the invaginated portion of the bowel does not become gangrenous, neither does the excluded portion of bowel become filled with fecal matter, as is claimed by some.

In cases where the disturbance is situated in the rectum, sigmoid flexure, or low down in the colon, when it is found to be impossible to approximate the severed ends of the gut or to perform anastomosis, colectomy will be required. Senn claims superiority of anastomosis over other means in that it is simple and rapidly performed; that the inequality in the size of the bowel to be united does not militate against its adoption, that the union can be made secure against leakage, that it is applicable in almost every form of disease and injury, and that different sections of the viscera are alike amenable to its methods.

OPERATION. After opening the abdomen the intestines immediately above and below the seat of injury are drawn out through the abdominal incision. The loops are then placed upon warm sterilized towels and the abdominal wound protected by packing the opening with gauze. The

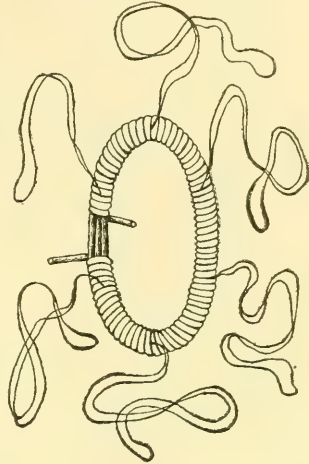


Fig. 609.
Abbe's apposition rings of sheep gut.

loops are then emptied of their contents by stripping with the fingers, and this empty state is maintained by constricting them with clamps, or bands, two for each loop, passed through the mesentery close to the intestine and about four inches apart. The bands constricting the lower segment may be tied at once. An incision is made into the proximal loop and the contents of the bowel completely evacuated and the parts thoroughly washed and cleansed. The incision is made into the convex side of the gut, opposite to its mesenteric attachment and in a longitudinal direction. It should be of sufficient extent to admit of easy insertion of the plate, but no larger, for fear the plate may escape through the incision after the sutures have been tied. The interior of the proximal loop is then thoroughly irrigated and rendered aseptic. The plate is now gently introduced by slipping it in edge-wise, and traction is made upon its sutures in such a way that its upper surface looks toward the incision. It is then adjusted so that its ends are of equal distances from the angles of the intestinal incision and is retained in this position by passing the needles of the lateral threads through all the tunics of the bowel from within to the outside, half way between the two ends and close to the margins of the incision, the end sutures being brought into the angle of the wound. The other loop is dealt with in the same way. The serous surfaces around the margins of the intestinal incisions are now lightly scarified, the extent of the scarification corresponding to the area of the

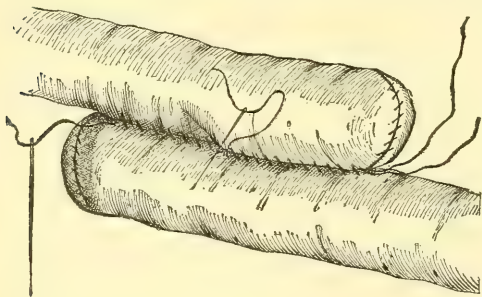


Fig. 610.

Lateral anastomosis by Abbe method. Sutures of intestine in apposition before incision.

subjacent plates, and not to sufficient depth to cause bleeding. The two loops to be united are then approximated so that the scarified surfaces shall come in accurate apposition and the incisions be directly opposite each other. The sutures are so arranged that when they are to be tied the corresponding ones may be found without difficulty. The serous surfaces over the posterior margins of the plates are drawn together by a few fine superficial stitches. "The posterior pair of fixation sutures is tied with sufficient firmness to approximate, but not to compress, the parts between them. The sutures are always to be tied in a square knot, so as to prevent slipping of the knot. Next, the pair of end, or approximation, sutures away from the operator is tied, and when this has been done the opposite pair is tied. All the sutures are cut short as soon as they are tied. The last sutures to be tied are the remaining pair of fixation sutures; and while these are being tightened the margins of the bowel are inverted between the plates with a director or probe. The cut ends of the last knot are pushed with a probe towards the opening." The function of the plates is next reinforced by uniting the serous surfaces over the anterior margins of the plates by a continuous suture (Fig. 601). The parts are then thoroughly cleansed and the constrictions around the gut released. If there has been any extravasation of blood or other matter into the peritoneal cavity this must be carefully removed and dried and the loop returned to the abdo-

men. The question of flushing the abdomen or applying drainage must be decided upon the same indications as in other intra-peritoneal operations. Drainage is advised when a resection of considerable extent has been done prior to the formation of the anastomosis, or where fecal or septic matter has been poured out into the peritoneal cavity.

LATERAL ANASTOMOSIS—ABBE'S METHOD. This operation in the hands of some surgeons has given excellent results and is worthy of the most careful consideration. It does away with the bone plates, sheep-gut and rubber rings and other material that require a previous preparation and a special technique. It is easy of execution and can be rapidly performed. The preliminary stage of the operation, the extrusion of a loop of the intestine, and the resection are the same as in circular enterorraphy. The two ends of the divided gut are closed by a row of Lembert sutures, after which they are placed alongside of each other so as to over-lap for about five inches and are united by two rows of continuous sutures (Fig. 601). These rows are placed one-quarter of an inch apart and extend one-half inch further in either direction than is intended to open the bowel; each thread is left so as to make the returning line of sutures. Both ends of the bowel are now opened near but to one side of the suture lines for a

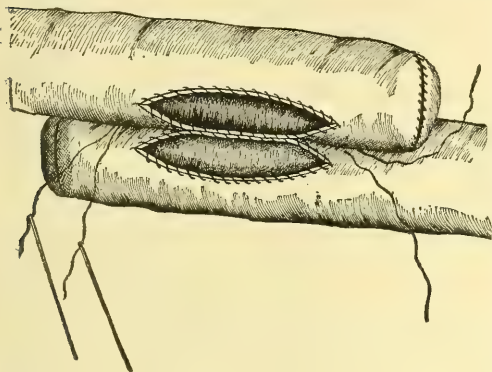


Fig 611.

Showing four-inch incision and sutured edges. distance of four inches (Fig. 611), the bleeding points being secured by catch forceps. The two adjacent cut edges are united by a whip-stitch (Fig. 611), so as to control the bleeding and release the forceps.

The two free edges are treated in the same manner as in Fig. 611. These free edges are then laid together and the serous surfaces of the gut united along the border of the cut by two rows of continuous Lembert sutures, the two threads left being used from the opposite side for the purpose.

End-to-End Coaptation and Anastomosis by the Murphy Button.—This most ingenious mechanical appliance for the establishment of anastomosis was devised and introduced to the profession by Murphy, of Chicago, who has published reports of his experiments in the use of the instrument, giving statistical accounts of the results obtained. In June, 1894, he gave a tabulated statement of thirty-seven cases operated on by this method with nine deaths. Of the cases that died four were operated upon for malignant disease, two fatalities were attributed to shock, and three to exhaustion. The results in these cases would probably have been no better had other methods been adopted. The operation with the button can be done more rapidly than by other measures. Individual operators have given even better results than this. Its author claims as meritorious points for the instrument that it dispenses with the use of sutures and the necessity of irrigation; that the technique is rapid and simple and the exposure of the abdominal viscera

is not prolonged, and that the possibilities of sloughing through, as in the bone plates, or the too rapid absorption, as in sheep-gut rings, are avoided.

On the other hand, it is claimed by those who oppose the method that the button is liable to lodge in the intestinal tract, especially at the ileo-cecal valve, thereby causing intestinal occlusion, and that in operations involving the stomach it is liable to fall back into this viscus and by its pressure expose the patient to additional dangers and inconveniences. In fact, cases are on record where, in effecting an anastomosis between

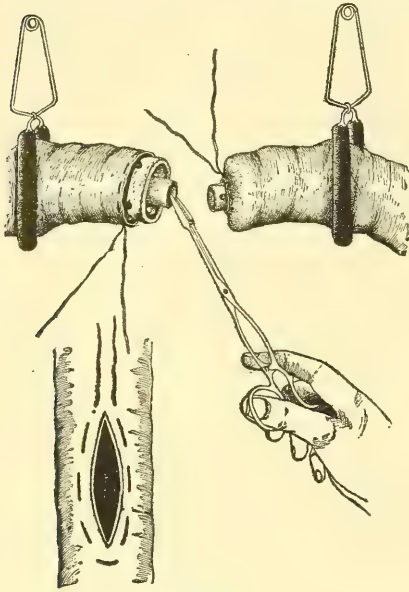


Fig. 612.

Enterorrhaphy and lateral anastomosis by Murphy button.

the gall-bladder and the duodenum by this method, the button has fallen back into the gall-bladder and remained there as a foreign body. It is also claimed that cicatrization of the anastomotic opening will in many cases be sufficient to cause obstruction of the bowel at that point. Abbe has reported a case of cholecystenterostomy by means of the button in which complete stenosis of the opening occurred within ten months.

The operation has many strong points in its favor, especially when applied to the large bowel, in regions where the large button can be used. It will stand in high favor with operators until some more efficacious and simple method is devised.

DESCRIPTION OF THE BUTTON.

The buttons are of three sizes. The largest is used for operations upon the colon and rectum, the intermediate size for the small intestine and stomach, and the smallest size in operations on the gall-bladder. Each button consists of two circular bowls. In a circular opening in the bottom of one of these bowls is inserted a female cylinder with threads upon the inner surface. Inserted in a similar manner in the bottom of the other bowl is a male cylinder, made so as to just fit easily into the female cylinder of the other bowl. On the inner surface of either side of the lower end of the male there are two springs, extending from near the top where small points protrude through openings in the cylinder for the purpose of catching the screw threads in the female. When uniting the two halves of the bowls the male cylinder is pressed into the female to the desired extent, the bowls being held at any desired point by means of the springs in the screw threads. When it is desired to separate them they are simply unscrewed. A small ring with a thin, though non-cutting edge, is placed in the male bowl and secured in position an eighth of an inch above the edge of the bowl. This ring is retained in its position by a wire spring, the object of which is to maintain a steady and persistent pressure upon the tissues between the two bowls until they are entirely cut off. However, this spring may be dispensed with in operations where the stomach is not involved. Owing to

the thickness of this viscus it is necessary that the pressure may not relax. Four openings are made in the sides of each bowl for the purpose of drainage.

OPERATION. The preliminary steps of the operation are the same as in circular enterorrhaphy. After the loop of the gut has been drawn out through the abdominal wound, emptied of its contents, clamps applied and the diseased portion resected, a running thread or a purse-string ligature is inserted into either end of the gut. This stitch should include the entire thickness of its walls. One-half of the button is inserted into the proximal end of the gut and the other into the distal end, and the purse-string sutures are tightened around the button so as to draw the incised edge well within the grasp of the cap (Fig. 612). The two parts of the button are then grasped with the fingers and pressed together. A sufficient degree of pressure must be used to bring the serous surfaces firmly in contact, so as to insure the death of the included structure. When the necrosed tissue inclosed within the cups separates the button drops out, leaving an opening equaling it in size. The button is passed per anum, usually in from ten to fifteen days, though it has remained within the intestine without injury as late as the fortieth day.

After the button has been adjusted a careful inspection of the parts should be made to see that the coaptation is perfect and secure, thus guarding against leakage. The bowel is dropped back into the abdomen after having been cleansed, the wound closed and the case managed in the usual way.

Where an anastomosis is to be effected the procedure is much the same, except that a longitudinal incision is to be made in the walls of the gut at the point at which the approximation is to be made, and the running loop applied as in Fig. 612. If a resection has been made and it is intended to make a lateral re-establishment of its continuity the open ends of the gut must be closed by sutures.

CHAPTER XVIII. COLOSTOMY.

Definition.—This operation, formerly described under the head of Colotomy, signifies the forming of a fistulous opening into the colon. There are two points through which the opening may be effected, the lumbar and the inguinal region. The former has been the operation in greatest favor until within the past few years. This was largely owing to the long accepted theory that great danger was engendered by opening the peritoneum. But since aseptic methods have come into use this ancient delusion has been dissipated through practical demonstrations in the experimental field of surgery.

History.—Littre, in 1710, was the first to advocate the feasibility of an artificial anus, but, strange as it may seem, considering the prejudice that then existed in regard to invading the peritoneum, he advocated the inguinal route. Pillore, of Rouen, was, it seems, the first to put the operation to a practical test in a case of cancer of the rectum. He made the opening into the cecum. His patient lived twenty-eight days. To Amussat belongs the credit of establishing the operation of lumbar colostomy, and the operation devised by him sustained professional endorsement until recently. The cause of election of this region is the fact that in a certain percentage of cases the colon is found to be only partially covered by peritoneum, lying in contact with the transversalis fascia on its posterior aspects, and it can be reached here without opening the peritoneum. Treves estimates that this occurs in seventy-four per cent. of cases on the right side, and sixty-four on the left; therefore it will be seen that in only about two-thirds of the cases can the bowel be reached without opening the peritoneum. Allingham reduces the number much below this. He figures it at about seventeen per cent. In some instances the mesentery will be found to be so long that the bowel is reached with great difficulty, even after the peritoneum has been incised.

The mass of tissue penetrated in the lumbar region in performing the operation is calculated to give excellent form to the artificial opening, but the situation makes it inconvenient for the patient to attend to his wants and to maintain a state of cleanliness. However, the operation is appropriate in a certain class of cases, where the disease is so situated that the inguinal incision would be below it.

Since the advent of modern antiseptic methods the trend of the profession is to return to the older method of Littre, inguinal colostomy. This operation is quickly and easily performed and places the fistula in a convenient locality.

Object.—Colostomy may be instituted either as a curative or a palliative measure, the seat and extent of the lesion governing the election of the site of the opening. Malignant disease and some cases of intestinal obstruction that are situated low down in the intestinal tract may require the adoption of this operation for their palliation. The

mortality of either method of operating is small, amounting to only about five per cent.

Colostomy is an operation ordinarily to be avoided. It should be resorted to only when other methods of relief are unavailing. The establishment of an artificial outlet for the fecal discharges from the bowels always engenders discomfort and misery. The person of the patient so afflicted is constantly contaminated with the odor of his own filth and, becoming an object of more or less disgust to his fellow men, he is practically banished from society. So when the operation is considered it must be with the view of saving or prolonging life, or relieving suffering when other means are not practicable. When it is done it should be with the consent of the patient, after he has had an intelligent understanding of the condition which it entails.

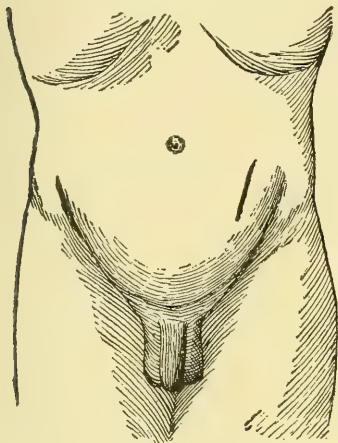


Fig. 613. Inguinal Colostomy
Parietal Incision.

side. With the patient resting in the right prone position a firm pillow or roll of cloth is placed under the loin (Fig. 614) in order that greater room may be obtained between the ribs and ileum. An incision is begun a little behind the border of the erector spinæ muscle, midway between the crest of the ileum and the ribs, and carried obliquely downward and forward to the extent of three or four inches, dividing successively the latissimus dorsi, external and internal oblique and transversalis muscles, until the outer border of the quadratus lumborum is reached, this muscle being in direct relation with the colon, being connected with it by loose areolar tissue. The surgeon must observe the precaution of preserving ample room throughout in making the incision lest a want of space may complicate his maneuvers; but the tendency is, usually, to carry it too far. The opening through the transversalis fascia, however, may be limited to the smallest possible dimensions, for by so doing unnecessary weakening of the abdominal walls will be avoided. When the sub-peritoneal fat is reached a careful search for the gut must be made. If the colon is distended with gases or feces it is readily recognized, but if empty it may be more difficult to find. In such cases the search may be facilitated by insufflation from below with either gas or air. When the gut is secured great care should be exercised lest a mistake

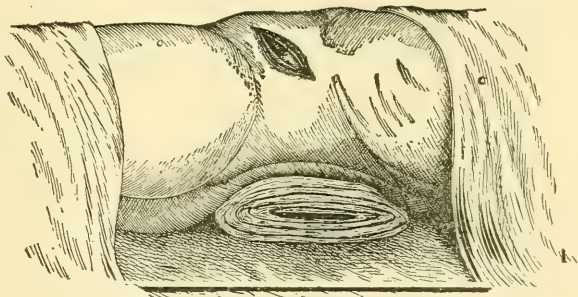


Fig. 614. Lumbar Colostomy.—Incision.

be made and some other part of the intestinal tract than that desired be opened. The distinguishing features of the colon, the convolutions and longitudinal bands, must be clearly recognized before the opening is made. If the incision has been carried too far forward and the abdominal cavity has been opened, the colon should be located by a search with the finger and the peritoneal rent then closed with sutures. No harm need be done by opening the peritoneum, and this had best be done and an exploration made with the hand if doubt exists in the matter of identifying the colon.

When the bowel is secured it is drawn out through the wound and attached to the skin by a row of sutures that includes the serous and muscular coats, one-sixth to one-fourth of an inch apart. In order to make a sharp bend in the bowel the main body of it should rest outside of the row of sutures. Unless important demands for the immediate opening of the gut exist this may be postponed for twenty-four to forty-eight hours until adhesions have formed. If a permanent opening of the fistula is to be maintained the incision through the bowel should be made in a transverse direction, but in case it is only to serve a temporary purpose the opening will be less difficult to close if it runs longitudinally. In cases where the operation is performed for conditions producing occlusion and the colon is found to be filled with hard fecal matter it is better that this be evacuated before the sutures are taken. Considerable ingenuity is sometimes required to effect this, and some mechanical means may have to be brought into requisition; a scoop or a spoon will often suffice.

AFTER-TREATMENT. The wound should be dressed with a bountiful supply of aseptic gauze covered by a piece of oil-silk and kept in position by a bandage. The wound must be attended with care and kept scrupulously cleansed, as the irritating properties of the fecal discharges are liable to produce eczematous abrasions of the skin. When this occurs the skin may be smeared with oxide of zinc ointment, which soothes and protects it. The bowel below the opening should be kept cleansed by frequent irrigations. If the fecal matter is inclined to pass down into the distal end it can be closed with sutures.

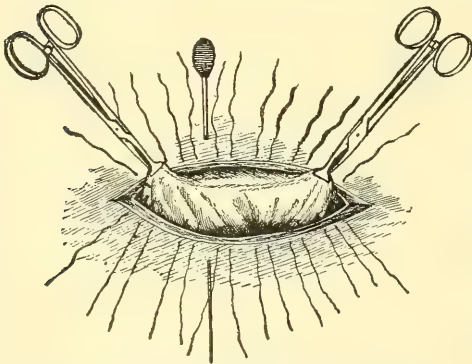


Fig. 615.

Iliac Colostomy.—Pins and Sutures applied.

Iliac Colostomy.—OPERATION. The abdomen is opened by an incision two and a half to three inches long, made at right angles to a line drawn from the anterior superior spinous process of the ilium to the umbilicus and one and a half inches to the inner side of the process. The margin of the divided peritoneum on either side is drawn up and united to the skin by a number of fine silk sutures. In this manner the abdominal wound is lined throughout with peritoneum; however, this procedure is not endorsed by all operators. The colon will frequently appear at once in the wound, but it is estimated that it will present in only one-third of the cases, the small intestine, omentum, or mesentery

presenting in the other two-thirds. Great care must be exercised in identifying the presenting part lest some other viscera be mistaken for the colon. It may be recognized by its regularly convoluted surface and longitudinal striæ. If it does not readily appear in the wound the finger should be introduced into the peritoneal cavity and the gut sought at the point at which it crosses the brim of the pelvis. Sometimes it is readily recognized by the presence of the fecal matter which it may contain. The extrusion of the small intestines must be prevented, as their exposure to the open air rapidly causes hyperemia and increases the liability to infection; besides, it is sometimes troublesome to return the coils that so rapidly escape through the wound into the abdomen. Their escape may be prevented by the introduction of gauze pads, or flat sponges. At this stage the manipulative procedures can sometimes be greatly facilitated by placing the patient in the Trendelenberg position.

The identity of the loop to be incised being established, it is brought into the wound and caught in the longitudinal band at either angle of the wound by two pairs of T forceps and drawn well out. A transfixion pin is then entered in the skin one-third of the distance from the lower angle, passed through the parietal wall, then made to engage the mesentery and to again pierce the wall of the opposite side from within outward in like manner. This gives a sharp angle to the gut, which is very necessary in order to prevent the passing of fecal matter into its distal end and securely fastens it into the wound, preventing the possibility of the stitches tearing out. This accident has happened, permitting the bowel to return to the abdomen and allowing extravasation of fecal matter into the peritoneal cavity, resulting in septic peritonitis. The gut is now attached to the skin on either side by several staple sutures of silk, and one in each angle. These sutures are applied with a half curved needle and include the edge of the skin and peritoneum, to which it is attached, and then the serous and muscular layers of the colon. When the operation is complete fully two thirds of the body of the gut rests outside of the line of sutures. If the exigencies of the case are not urgent the opening of the bowel may be postponed for forty-eight or seventy-two hours, or until firm inflammatory attachments have taken place. The wound is now covered by perforated rubber protective, over which a plentiful supply of sterilized gauze is held in position by a bandage. Should the severity of the symptoms render it necessary the bowel may be opened at once. The gut is incised along the longitudinal band with a sharp pointed bistoury, the edges are then grasped on either side with a pair of forceps and the tissue is cut away on a line almost down to the sutures. The pin should be withdrawn when firm union has taken place. The sutures may be removed at the expiration of ten days. The wound is dressed with vaseline or oxide of zinc ointment and a pad of gauze is applied and sustained in position by a bandage. The patient is usually up in a fortnight and is soon able to go about as usual.

AFTER-TREATMENT. In the after-management of the fistulous opening there is nothing better than a fold of linen annointed with oxide of zinc ointment or vaseline, reinforced by a pad of wool (which is non-compressible and elastic), and supported by an elastic bandage.

SECTION XXI.
**SURGERY OF THE PERITONEUM, LIVER AND
PANCREAS.**

CHAPTER I.
TOILET OF THE ABDOMEN.

Preparation.—The toilet of the abdomen should begin with the most thorough preparation of the skin at the site of operation. Complete asepsis must be sought by the frequent exchange of the towels spread about the incision, which quickly soil, for those which are clean, and the strict observance of the rules which govern the arrest of hemorrhage before the peritoneum is divided. As soon as the abdominal cavity is reached a small flat pad of gauze should, if a large tumor is not present, be carried through the upper angle of the wound and left in the abdomen with the external end folded over on the skin at the top of the incision. This precaution, in operations free from extensive adhesions, will absorb the serous fluids or blood, if any, and when the operation is finished the abdomen may be closed without any further care. In occasional cases, however, it may be prudent to carry a sponge down into Douglas' pouch to remove any fluids that may have gravitated into this pocket, either before or during the operation. If non-septic discharges are present they should be removed by careful sponging only. Considerable blood or serum may be left with impunity, but it is more surgical to remove them.

Irrigation.—Where the fluid is supposed to be septic the greatest care must be taken to wall off the healthy tissues so as to protect them from the discharges. If they do become infected, septic peritonitis or mural abscesses may develop even if the best means to neutralize the ptomaines are employed during the operation. In the removal of ovarian abscesses, pus tubes and the like the pelvic cavity is frequently contaminated, demanding the use of peroxide of hydrogen, full strength, on a moistened dossil until all action from the agent ceases. When this course is taken the abdomen may be closed either with or without drainage; generally the use of the tube for two or three days is safer. Sometimes the surgeon may find it more convenient to employ the peroxide with sterile water in the proportion of one of the former to six or eight of the latter. Plenty of sterile water, salt or Thiersch's solutions, with drainage, does quite as well as the peroxide. Where pus, bloody fluid, or any septic substances, as found in pyosalpinx, hematosalpinx, hydrosalpinx, degenerated extra-uterine pregnancies or ruptured abscesses, diffuse their way into the abdominal cavity irrigation must be employed.

APPARATUS. The best apparatus for this purpose may be constructed in a few minutes, if a glass funnel, a piece of rubber tubing one foot long, and a glass tube six inches long be at hand. (Fig. 616). The calibre of these tubes and the delivery end of the funnel should be about one-half inch in diameter, and the glass tube and the funnel should be connected by the rubber tubing. An assistant holds this irrigator in position while the surgeon has both hands free to manipulate the glass tube in the pelvis or abdomen and prevent the escape of the intestines, while two nurses with pitchers keep the funnel filled with sterile water at a temperature of 110 degrees Fahr., or the Thiersch's or salt solution may be preferred. If the salt solution is used, which is not important, it should be introduced in the proportion of

R
Chloride of Sodium..... 3 i.
Sterile Water..... $\frac{3}{4}$ xvi.

If the boro-salicylic solution is selected it should be employed in the following strength:

R
Salicylic Acid..... Parts ii.
Boracic Acid..... " xii.
Hot Water " m.

A sufficient quantity of one or the other of these solutions should be at command so that no time need be lost in their preparation. Often their use is fussy and unnecessary, and many surgeons content themselves with sterile water only. It is not so important what antiseptic is used as it is to see how neatly and quickly the work is done; for this treatment is indicated only in long and badly complicated operations and if much time is wasted with fussy solutions or incomplete irrigation the last chance to save the patient will be lost.

This irrigation tube possesses quite an advantage over the pitcher, as it washes all debris up from the bottom. When the latter is employed this septic matter must be stirred up from the bottom of the pelvis with the fingers, while alternate pressure is made on the abdomen with the other hand to force the water and debris out. When the water or solution comes away clear and free from blood-clots or shreds, a glass drainage tube with a calibre of one-half of an inch is introduced and the wound is closed about it. (Fig. 617.)

If this tube is perforated at its lower end the openings must be less than one-sixteenth of an inch in diameter; if they are

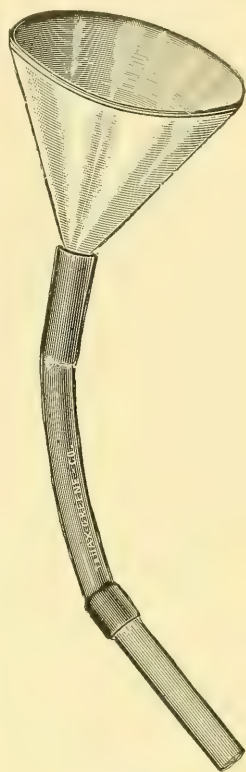


Fig. 616.
Funnel and Tube.

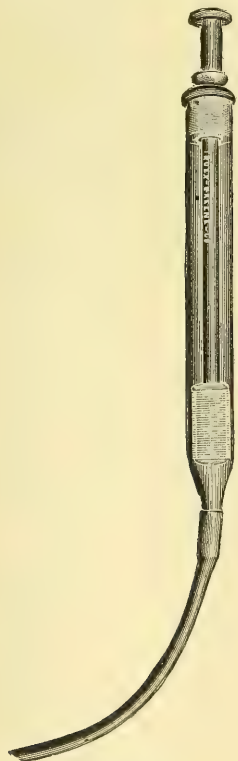


Fig. 617.

Glass Drainage Tube.

more than that the omentum or mesentery may be sucked into them by the syringe during the removal of the fluid, and render difficult, or perhaps prevent, the extraction of the tube, unless the abdomen is re-opened for this purpose. No effort should be made to sponge the water



Fig. 618.
Perforated Tubing.

out of the abdomen. Its presence serves to float the intestines into place, and its removal in this way only further irritates the peritoneum. A better way to remove it is with an eight inch glass rectal syringe to which a bit of rubber tubing six inches long is attached. (Fig. 618.)

The distal end of this tube should be beveled off so as not to suck up the tissues in the bottom of the pelvis and wound them. While the stitches are being introduced an assistant may be directed to draw the fluid off.

CHAPTER II.

PERITONITIS.

General Considerations.—Peritonitis is but very rarely, if ever, idiopathic. The varieties which interest most are due to traumatism, infection, or extension of the inflammatory process from various abdominal viscera. It frequently follows Bright's disease, pyemia, erysipelas, abdominal cancer, perforative ulceration of the intestines, as well as cirrhosis of the liver and valvular insufficiency of the heart. When peritonitis is present as a sequel of these diseases it is of no especial interest to the surgeon, except as it becomes necessary to make a careful differential diagnosis or to perform paracentesis as a palliative measure. The only possible exception to this statement is in ulcerative perforation of the stomach, duodenum, or other portions of the intestinal tract, due to various causes, among which may be mentioned extensive cutaneous burns or typhoid fever. The most important point, then, for the surgeon to bear in mind, is that the disease is symptomatic, that he should always search for its cause and be sure that appropriate treatment is employed early.

Etiology.—The etiological factors of ninety-five per cent. of the operative cases are: Diseases of the uterus and its appendages, the gall-bladder and its ducts, traumatism, the appendix, cecum, and, but very rarely, other portions of the intestinal tract. From these causes the disease may assume four forms: Plastic, fibrino-plastic, septic, and suppurative peritonitis.

Plastic Peritonitis.—This results from traumatism or non-septic irritants, either chemical or mechanical, and is nature's way of repairing the injury by the walling off of the foreign body or other causative matter. It is purely a local disease, and does not extend much beyond the seat of irritation. Lymph is poured out in sufficient quantity at the end of a day or two to cover the viscera and form a thick investment of the organs and tissues around the affected area. This lymph organizes and forms tough adventitious tissue which unites, with great strength, the peritoneal surfaces about the irritant, and completely encysts it and shuts it off from the peritoneal cavity. This fibrous membrane about the viscera may contract and produce intestinal obstruction.

SYMPTOMS. The fever is due to the same cause as in traumatic fever, the absorption of fibrin ferment or the products of tissue change, and ranges from 99 degrees to 102 degrees Fahr. The pulse varies usually from 80 to 110 beats per minute and is of good quality. As this is purely a regenerative process, such as attends every aseptic wound of the peritoneum, the symptoms are much the same as those observed after successful operations on this membrane. There is tenderness, rigidity and local pain, attended by backache, which is common to all peritoneal trauma, especially about the pelvis. The prognosis is good.

TREATMENT. In the treatment the surgical principles appropriate to

each case must be carried out. If the bowels are obstructed as a result of contraction of the fibrous bands abdominal section must be performed for its relief. Or, if an abdominal operation has already been performed, and plastic peritonitis has developed about the drainage tube, a common site, or elsewhere, and caused intestinal obstruction the wound must be re-opened to release the constriction.

Owing to the great strength and adhesive qualities of this adventitious tissue, which may be the sixteenth of an inch thick, it will be found difficult, even two or three days after the inception of plastic peritonitis, to separate the adhesions of the intestine without imminent danger from laceration of its coats.

Liquid diet as employed in abdominal operations should be given for two or three days, the patient being then gradually allowed solids. Hot or cold applications may be employed according to the indications, and absolute rest enjoined.

Fibrino-Plastic Peritonitis.—This disease has points of resemblance of both plastic and septic peritonitis, and results from the ptomaines of one or more germs of the staphylococci or streptococci groups of micro-organisms. Although very septic in its nature and produced by the same cause as suppurative, or septic peritonitis, it is by no means as deadly as the latter malady. If the patient survives the first toxic impression upon the system numerous adhesions may form, the disease become circumscribed and peritoneal abscesses develop, and the lesion then becomes sub-acute or even chronic.

The general treatment in the beginning is similar to that of septic peritonitis. When abscess forms its treatment is the same as that advised for the management of circumscribed tubercular or suppurative peritonitis.

Septic Peritonitis.—With one exception there is a strong septic element in all the varieties of peritonitis described in this chapter. In this form of the disease, however, either from pre-disposition, the introduction of an overwhelming dose of toxic alkaloids, or both, the patient dies, sometimes during the first day, before any marked pathological changes of the peritoneum take place.

The disease may arise from infection through the uterine lymphatics after parturition, or slovenly operations upon the womb, perforation of intestinal ulcers, rupture of pyosalpinx at child-birth or any other time, punctured and gunshot wounds, rupture of abscesses, migration of cocci through diseased intestine, strangulated hernia and abdominal operations.

SYMPTOMS. When the disease is the result of perforation of the intestinal tract, especially ulcerative appendicitis, there is sudden intense circumscribed pain which soon becomes general. If it follows parturition, abdominal injuries or operations, the pain is slight or it may be absent altogether. Sometimes the disease is ushered in by a chill; more frequently there is none, and the patient presents many of the symptoms of profound shock; the pulse becomes very rapid—from 140 to 170 beats per minute. It is thready, and within a few hours from the inception of the disease is imperceptible at the wrist. The temperature is often sub-normal soon after the operation, or the introduction of the ptomaines into the system, and does not again reach the normal point during the course of the disease. The vomiting—of a light watery substance, attended by

retching, shortly after the patient is placed in bed—gradually becomes less difficult, the fluid grows darker until it is of a brownish-red color, and the patient spits it from the mouth without any effort whatever. The tongue becomes dry, brown or red, and the bowels are usually greatly distended and tympanitic. In rare cases, however, there is but slight distension over the epigastric region, or none at all. The intellect is generally clouded, but it may remain clear until the last. The countenance presents a pale, haggard or cadaverous expression; the pulse is imperceptible at the wrist for many hours before death; the extremities become cold, clammy and livid, and the veins are distended and purple. There is often no result from enemata of any description, and cathartics have no effect unless given early.

The disease is almost invariably fatal; death results usually in from twelve to seventy-two hours, but in very rare cases it may not occur for a week or the patient may possibly recover.

TREATMENT. When septic peritonitis is well established there is no treatment that may be applied which affords more than the faintest hope of recovery. Therefore, the most rigid prophylaxis must be employed. All abdominal wounds should be scrupulously guarded against the entrance of septic matter from whatever source, and when pus is already known to be present it must be thoroughly removed and the parts so treated as to prevent infection during the operation if possible. For, after the disease once gains headway flushing of the abdominal cavity or anti-septic treatment of the wound will not be likely to afford relief. The malady must be anticipated especially in pus cases, and the abdomen flushed if necessary with the Thiersch solution and good drainage employed. When the patient is placed in bed he must be constantly watched and appropriate treatment applied at the right time. If the pulse tends to become rapid and thready, the abdomen begins to distend, the light-colored ether-vomit changes to the peculiar emesis of sepsis—in which the ejecta changes to a brownish-red tinge, and is thrown off from the stomach without effort—then copious enemata of soap and water, or turpentine emulsion and water, must be persistently employed until the gas is started. If this result is not attained and the patient's condition grows worse the gas must be expelled at all hazards, else the muscular coat of the intestines will be paralyzed and the last hope lost.

The advisability of thoroughly clearing the intestinal tract previous to operation is generally admitted and the drugs which are administered for this purpose are not in any sense regarded as curative agents, nor has their administration any relation to therapeutic medication. The post-operative moving of the bowels is often far more important than is their evacuation before a surgical operation, and in both instances the drugs are administered on the same principle, and that is as medico-surgical aids, which are valuable for their mechanical action.

Sulphate of magnesia may be given in two-drachm doses hourly, or an ounce at a time, owing to the urgency of the condition. If preferred Epsom salts in one-drachm doses may be alternated with Rochelle salts every two hours. Some surgeons in place of these remedies prefer Seidlitz powder in either full or divided doses, administered every half hour to every four hours, but it is usually not as efficient as the salts. If these drugs cannot be retained, which is sometimes the case, mer-

curius dulcis may be given in broken doses of the crude powder or in a single full dose thereof as the case demands. This treatment not only expels gas, liquid passages, and prevents dangerous distention, but it promotes absorption of fluids within the peritoneal cavity and eliminates toxic alkaloids. Stimulation or remedies to strengthen the heart's action may be employed, but in most cases nothing will do any good unless the distention or intestinal paralysis is relieved.

Suppurative Peritonitis.—This type may be either diffuse or circumscribed, and, like the fibrino-plastic and septic varieties, is due to pyogenic germs introduced through the medium of intra-abdominal diseases, like ulceration of the appendix, cecum, stomach, gall-bladder, or of other viscera. It is not necessary for perforation to take place as the peritoneum may be infected when the intestines are only weakened from inflammatory or ulcerative disease which stops short of the peritoneum. In other cases the infection may be conveyed through the lymphatics, and by abdominal injuries or operations.

These micro-organisms produce in one patient suppurative, in another fibrino-plastic and in a third the deadly septic peritonitis. In the latter disease the poisonous alkaloids are introduced in larger quantities, and are more diffuse; the peritoneum absorbs them with greater facility; the system has less power of resistance, and the patient dies from the effects of an overwhelming dose of the ptomaines before there is any pathological change. In suppurative and fibrino-plastic peritonitis, however, these conditions are not so favorable to extreme sepsis, the tendency is to circumscription, consequently, the surgeon may apply his art with much greater prospect of success, and the majority of the patients are saved.

SYMPTOMS. Suppurative peritonitis is characterized by more or less severe and constant pain, accompanied by chills and high temperature which ranges from 102 degrees to 104 degrees Fahr. Unlike tubercular peritonitis it always develops suddenly, the pains are not colicky, and only in exceptional cases is the temperature normal or sub-normal. When the disease is general fluid may be discovered in the flanks by the dull percussion note, which changes as the patient turns on the side or sits erect, the pus again accommodating itself to the most dependent part of the abdomen. The muscles are tense, and the patient takes the level dorsal position to relax them and ameliorate the pain. The abdomen is distended, tympanitic, and very tender. Vomiting and constipation are generally present, and sometimes the vomiting becomes stercoraceous. This latter symptom may be due to paralysis of the muscular coat of the bowels and complete inaction, or to organic obstruction. It is impossible to tell which, as there is no way to distinguish between the two conditions clinically. When, however, the distention is due to neither of these causes but to intestinal perforation, or to gas from putrefaction of debris within the abdomen, there may be fecal vomiting; in short, the symptoms may be the same as in the two conditions above described, but the physical signs are widely different and characteristic. In the two latter conditions the abdominal cavity itself, instead of the intestines, is enormously distended, and the gas occupies the space between the anterior abdominal wall and the liver, the dullness from this organ disappearing entirely. If the tympanites is due to either of the first causes of course the gas is in

the intestines themselves, instead of the abdomen, and the liver is crowded up higher than in health, but its otherwise normal lines of dullness may readily be made out. If the abdomen is distended from perforation, and gas is free in its cavity, there will be present not only the physical sign just mentioned—entire absence of the liver dullness—but probably a history of sudden, sharp, localized pain, also, at the time of the rupture, accompanied by shock and possibly fecal vomiting.

TREATMENT. If the disease is general, the abdomen is to be opened, flushed out with Thiersch's solution, and careful search made for the cause; if found, it must be removed if possible and the peritoneal cavity thoroughly drained. When the malady is circumscribed, the exploring needle should not be used until adhesions have formed between the abscess and the abdominal wall, unless the surgeon is prepared for immediate operation; then the needle may be introduced, and, if pus is present, immediate operation is demanded. If this course is not taken, pus may ooze through the puncture, infect the abdomen, and result in general suppurative peritonitis.

Again, the abdominal walls may be incised, the abscess sac exposed, and if it has sufficient strength and tissue it may be treated as follows: When the free surface of the abscess is exposed the trocar is introduced and the pus allowed to escape; then Spencer Well's forceps are applied to the relaxed sac each side of the canula, transversely to the abdominal incision, and the sac drawn forward through the wound. It is then incised between the forceps, washed out with peroxide of hydrogen one to six, and sutured to the cutaneous border of the wound by means of a continuous silk suture. The needle is made to pass through the skin and peritoneum at each stitch, as described under the head of circumscribed tubercular peritonitis. This cannot always be done until the abscess becomes sub-acute or chronic. If adhesions have formed between the swelling and the abdominal peritoneum the incision must be made through the adherent area, and great care taken not to wound the intestine or separate the adhesions from the abdominal wall. Where there is not such union, and the sac cannot be stitched to the incision, it is safer to do the operation in two stages. An abdominal incision is made over the most prominent part of the swelling and the incision is packed to the face of the abscess with iodoform gauze. (Fig. 622). When plastic peritonitis has walled off the gauze and shut the peritoneal cavity out from the upper surface of the abscess it should be opened, washed out with peroxide of hydrogen one to six, and drained or packed. If none of these procedures are applicable the cavity of the abdomen may be walled off with gauze pads, and the abscess may then be opened, possibly without general infection. After the pus is removed the sac should be treated with dressings saturated with strong peroxide of hydrogen, applied to the wound by means of sponge-holders, until all action from the agent ceases. If no contamination has taken place about the abscess the wound may be closed with good drainage; or, if there be a question as to whether infection has taken place the peritoneal cavity must be flushed with Thiersch's solution and closed with drainage. Although the surgeon should search thoroughly for the cause of suppurative peritonitis it is by no means always possible to find the lesion, even though it be present; since, in rare cases, infection may gain entrance

from disease in the mucous surface which is not visible on the peritoneal side of the intestine.

If perforation has taken place cathartics must not be used under any circumstances, but the abdomen must at once be opened, if the patient can stand it, by an incision over the site of the pain if the lesion cannot be reached from the median line. If the intestinal perforation cannot be found within a reasonable time rectal insufflation of hydrogen gas should be resorted to as practiced by Senn. When the perforation is found it should be carefully sutured in such a direction as not to materially narrow the lumen of the intestine, and the abdomen flushed out and drained. The use of a good-sized tube should never be neglected, as the peritoneum is always infected. On the appearance of the first symptom of septic peritonitis the saline treatment had better be employed, and a half-ounce or an ounce of sulphate of magnesia given at once. If the effect is not prompt it is better to assist the action of the salts by copious soap and water or turpentine enemata.

CHAPTER III.

TUBERCULAR PERITONITIS.

Definition.—Although tubercular peritonitis occurs simultaneously with phthisis, tubercular disease of the bones and other tissues and organs, it frequently develops as a primary lesion of the peritoneum. There are three forms of the malady: The milliary, the caseous, and the adhesive.

Milliary Tuberculosis.—The dropsical variety of tuberculosis is, fortunately, the form most frequently met with by the surgeon. The peritoneum, in some cases, is slightly thickened and reddened; in others the hyperemia and milliary changes, together with the hypertrophic process, go on until the membrane is thickened even to a quarter of an inch. It is inflamed, studded everywhere with milliary nodules, and presents a very angry appearance. Ascitic fluid is poured out in some cases until the abdomen is distended so symmetrically that it is impossible to diagnose this disease from large unilocular ovarian cysts. Indeed it was these mistakes in diagnosis which lead to the development of successful surgical treatment.

In other cases the disease is not so extensive. It may attack the broad ligaments, the Fallopian tubes, or other sites of the peritoneum and remain inactive without any appreciable symptoms for years; then the disease invades a larger area, pours out fluid which is limited by the formation of a capsule composed of adherent coils of intestine, the omentum, the uterus, or other organs and a segment of the parietes. When the disease develops in the pelvis, which is a common site, it is impossible, before operation, to diagnose it from certain tumors and diseases common to the tubes and ovaries. Another usual location is in the right hypochondriac region, where it may be difficult to make a differential diagnosis between diseases of the gall-bladder, the kidney, the liver, or even the vermiform appendix.

The fluid is not as variable in its appearance as that of ovarian cysts, nor as purulent or flocculent as the secretions found in the caseous form of this disease; it resembles more nearly the straw-colored fluid of ascites, due to cardiac disease. It may vary from a few ounces in the circumscribed variety to many gallons where the disease is general. In this form of the malady there are not many adhesions, and aside from the intensely reddened, hyperemic and nodular appearance of the peritoneum no marked ocular pathological changes appear.

SYMPTOMS. There is a long prodrome, or the disease develops suddenly and its early symptoms may not be observed. The pain is sometimes paroxysmal and resembles colic. Again, the patient is stricken down with characteristic peritonitis from which he recovers only to be afflicted with recurrences of that disease. The temperature varies from 101 degrees to 103 degrees Fahr., and there are evening exacerbations and morning remissions, when a sub-normal mark is frequently recorded.

In some instances the symptoms subside completely, the patient does not suffer any inconvenience, except from the fullness and oppression due to the abdominal distention. Any of these conditions may be accompanied by indigestion, diarrhea, or constipation. Unless the disease remains inactive for a time there is loss of appetite, general depression, and emaciation.

Caseous or Ulcerative Tuberculosis.—This is a much more dangerous form of the disease and has a very different pathology. The glandular elements of the peritoneum and its deeper tissues are the seat of degenerated tubercles, which pour out a cheesy fluid, and fragile false membranes of a buckskin gray color cover the intestines, the liver, and the other organs of the abdomen as well as the parietes. Sometimes this tubercular membrane has a texture sufficiently strong to hold gallons of fluid in the cavity of the abdomen after all the tissues have been divided by an exploratory incision, and the fluid only escapes when the trocar is introduced, perhaps with the false impression that adherent cystoma is present. Then it bursts out around the instrument as if it were inserted into a rotten-walled ovarian cyst, and, even then, it may take the surgeon a few moments to discover the true condition. The abdominal viscera are more or less agglutinated by this membranous product of tuberculosis. Occasionally various small cysts are found that contain fluid, which ranges in color from a dirty yellow to a brownish hue. Its density is quite variable, and it contains much tubercular debris, as well as pus, blood, and bacilli; or the greater portion of the substance may be puriform. Again, one cyst may be serous, another purulent, and a third bloody. Not infrequently these pus collections burrow through the intestines or other organs and cause fistulæ. Oftener, however, this troublesome complication is due to the degeneration of the peritoneal or sub-peritoneal tubercles and the fistulæ result through the process of ulceration.

SYMPTOMS. The earliest symptom is abdominal pain, which may cause the patient to keep to his couch; more frequently this is accompanied by high fever, characterized by morning remissions and a general condition, which is somewhat similar to that of typhoid fever. In either case the malady is more like that of acute peritonitis and is often so diagnosed. After a week or ten days the symptoms may disappear and the patient remain quite well again for several months. More frequently, however, the acute attack passes off and a chronic malady remains, with a temperature in the evening ranging from 100 degrees to 102 degrees Fahr. There is abdominal distention and tenderness, and occasional pains, especially in the pelvis or under the liver. The appetite is impaired, the bowels are either constipated or diarrhetic, with hectic flush and loss of flesh. The disease may spread to the pleura and give rise to characteristic symptoms of inflammation in that membrane.

Adhesive or Fibroid Tuberculosis.—There is no fluid found in the peritoneal cavity in this form of the disease. The intestinal, parietal, and omental peritoneum are studded with milliary tubercles, and the intestines, especially in the pelvis, are covered with fibrin and adherent one to another and to the tissues with which they lie in contact. This gives rise to a large boggy mass discoverable on palpation, a condition which has been sometimes mistaken for various tumors, and led to

unsuccessful operations. Although the exudation of fibrin is slight a strong adventitious tissue is formed, which may contract and cause intestinal obstruction from the narrowing of the lumen of the intestine or the binding together of a large extent of the organ and thus paralyze its peristaltic action. In this form of the disease, also, ulceration may take place, the intestines or other organs be perforated, and fistulae be established between them. The fecal or tympanitic abscesses may form and rupture through the abdomen and form fecal fistulae.

SYMPTOMS. Usually there are no symptoms which clearly indicate this disease; it cannot be diagnosed positively until an exploratory incision is made. There is, however, more or less tympanites, tenderness, constipation, and the food frequently passes only partly digested. The stomach is irritable, and nearly every form of food taken causes distress. There may be a tubercular history, or not, and the presence of tuberculosis may be discovered in some other part of the body. The temperature, as in the other forms, is elevated, though not as high as in the caseous variety, and it is characterized by sub-normal morning remissions.

Diagnosis.—The diagnosis of tubercular peritonitis is by no means an easy matter. The two dropsical forms, when the abdomen is not too much distended, may be differentiated from ovarian cyst by turning the patient on one side, when the fluid will gravitate to the most dependent part, then the percussion note will be dull over the fluid area, with resonance above it as the intestines float, if not too adherent. If the patient is turned on the opposite side or placed in the sitting posture the fluid will be found again at the lowest part of the abdomen, and the resonant note above the level of the fluid. These conditions, in the absence of cirrhosis of the liver or valvular disease of the heart and associated with a tubercular history make the diagnosis tolerably certain. If fluid is drawn off with the exploring needle the microscope may show beaded rods or tubercular bacilli, which render the nature of the disease certain. There is no way, however, to make a differential diagnosis between a large unilocular ovarian cyst and a fully distended abdomen from the dropsical forms of this malady except by the exploratory incision or the microscope. If the deposit of a bit of fluid is taken and subjected to a careful histological examination it may and probably will be possible to find the characteristic Drysdale granule-cells of ovarian cyst if the disease is ovarian, and beaded rods or tubercular bacilli if tubercular peritonitis is present. However, an absolute diagnosis is not imperative as abdominal section will decide the question; and since it is the appropriate treatment in either case the diagnosis may be made when the abdomen is opened and the conditions treated according to the indications. In the circumscribed variety of milliary tuberculosis of the pelvis it is necessary to differentiate it from cystic tumors of the ovaries, accumulations of pus developed from diseases of the appendages, and extra-uterine pregnancies. If the disease is located in the right hypochondriac region a differential diagnosis must be made between dropsy or empyema of the gall-bladder, diseases of the liver, appendicitis, and even hydro-nephrosis and pyo-nephrosis. In all of these conditions, except the diseases of the kidney, the exploratory incision is the best course to take, but the surgeon must not attempt it until he feels himself

competent and thoroughly prepared to properly treat any condition that may be encountered.

There is no possible way to determine whether a given case is of the milliary or caseous variety until the abdomen is opened; then the caseous is readily distinguished from the milliary by the presence of its fragile membrane of buckskin color, and the larger tubercles found in various stages of disintegration and ulceration.

The adhesive, or fibroid variety, when located in the female pelvis, cannot be diagnosed from adhesions due to various diseases of the reproductive system, unless the microscope shows the beaded rods in the discharges from the fistulæ, or the exploratory incision the milliary tubercles. However, any patient who has a tubercular history or is affected with tuberculosis in other parts of the body, and has tympanitic or fecal abscesses associated with fistulæ, furnishes strong presumptive evidence of the disease. Again, when the malady occupies the abdomen generally the illy-defined, slightly movable, doughy mass, coupled with intestinal obstruction and a tubercular history, affords strong evidence of the existence of tubercular peritonitis.

Treatment.—In the milliary and caseous varieties of this disease abdominal section is the only proper treatment. It cures a large per cent. of the cases when the disease has not progressed too far and has its primary seat in the peritoneum. Many such operated cases have enjoyed good health for a quarter of a century or more, and have died from other causes. Others may relapse in a few weeks or years, or tuberculosis develops in other parts of the body. When the disease is general the abdominal incision should be made down to the peritoneum in the linea alba, between the pubes and the umbilicus; then the patient should be turned on her side, the peritoneum opened for a third of an inch and the fluid allowed to flow into a receptacle, the dorsal position being again assumed. The short cut in the peritoneum is enlarged to the full extent of the incision, and all the fluid carefully removed by soft towels or pads of gauze. If tubercular ovaries, tubes, omentum, or other parts be encountered in a hopelessly degenerated state they must be removed. If the fluid appears to be of an especially septic nature, instead of drying the cavity out with sponges it is better to quickly and thoroughly flush the abdomen with a salt solution and introduce a capillary drain. Place a medium-sized tube, previously loosely packed with iodoformized gauze, down to the bottom of the pelvis, and close the abdomen about it. Now seal the wound up with a ten per cent. mixture of iodoform and collodion and place a light dressing of gauze and cotton over it. Then fit a piece of gutta percha, one foot square, snugly about the tube by breaking a hole through the center of the rubber. This affords a good protective for the wound and plenty of gauze and dressings may be placed over and about the tube to absorb the discharges.

Circumscribed milliary tuberculosis is also treated by incision and drainage. In some cases, however, where a strong sac of the surrounding organs and parietes held together by adventitious tissues has formed, it is well to lay the sac open and stitch it to the abdominal wound. This is best accomplished by a continuous silk suture, which should begin at one angle of the wound and be carried completely around it to the starting point. The sac should be brought up to the border of the skin all the

way around, if possible, and the thread in the eye of the needle tied to the other end of the same thread, which was left free for two or three inches for this purpose. Then employ drainage by means of rubber tubing, or pack the cavity with iodoform gauze. In either case the cavity must be washed out with a solution of peroxide of hydrogen with water, in the proportion of one to six. When the cavity is too large to be packed, good drainage must be employed.

The treatment of caseous tuberculosis does not yield as good results as the milliary variety. Yet, as a differential diagnosis is impossible before abdominal section, it should be dealt with the same as the above, except that the abdomen should always be flushed with a salt, or a weak boro-salicylic solution. It is better not to resort to surgical treatment in the adhesive or fibroid variety, unless there is obstruction of the bowels from cicatricial contraction of adhesive bands, or arrest of function due to imprisonment of a considerable extent of the intestine. The tympanic abscesses, too, may require incision, drainage, or packing.

CHAPTER IV.

ABSCESS OF THE LIVER.

General Considerations.—In tropical latitudes hepatic abscess is more frequently found than in our own country, and extreme heat is regarded as a powerful etiological factor. It is not often encountered in temperate climates, except as a result of trauma, emboli—usually from appendicitis or operations upon the rectum—pyemia, and, in rare cases, typhoid fever. It may also develop during the course of malarial diseases, dysentery, or from suppuration of hydatid cysts.

Several small abscesses generally form in the substance of the liver and break down into one large cavity, which may be deeply seated, usually in the posterior surface in the right lobe. This abscess may point and open into the hollow abdominal viscera, the lungs, or come to the surface through the abdominal wall. Any of these terminations are considered fortunate; but since the patient may succumb to the disease without such a favorable result, or the pus may as readily discharge into the pleural or abdominal cavities, surgical treatment had better be employed early, when there is greater prospect of success.

Symptoms.—There may be no symptoms present which direct especial attention to abscess of the liver: Lameness of the shoulder, slight pain and tenderness in the right side, and chilliness accompanied by moderate fever, may serve to arouse suspicion. In other cases the fever may be very pronounced and the temperature range from 102 to 104 degrees Fahr.; the patient is usually confined to the recumbent position and the slightest change in bed causes excruciating pain. There is loss of flesh, indigestion and constipation, accompanied by harsh and yellow skin, mental depression, jaundice, and in rare cases abdominal or general dropsy. Sometimes the enlargement of the liver is very apparent, and fluctuation is readily appreciated.

Treatment.—If abscess of the liver is suspected, it is well to explore the organ with a fine aspirator needle. When it is introduced it is allowed to move freely up and down with the respiratory efforts, else the delicate tissue of the liver may be lacerated and the abdomen infected. Occasionally abscess of the liver has been cured by repeated aspiration, but, as this result cannot often be hoped for, it is much safer to reserve the needle for exploration, and, when pus is found, perform hepatotomy.

HEPATOTOMY.—If the organ is enlarged and strongly united to the abdominal wall by inflammatory adhesions this operation will consist in the simple incision of the parietal and hepatic tissues, coupled with antiseptic irrigation and drainage. The best germicides for this purpose are the Thiersch solution, and peroxide of hydrogen, one part to six. If hemorrhage of the cut surfaces of the liver is encountered, it may be controlled by an overhand suture of large sheep-gut, or by packing the cavity with sterile gauze. Where there is danger that the hepatic adhesions may break away a large silk suture instead of sheep-gut should be

passed through the parietal and hepatic tissues, and thus not only is the hemorrhage controlled but the surgeon is assured that the liver will not be loosened from its attachments to the abdomen. This latter accident would probably defeat the best directed effort to save the patient. This is the simplest form of hepatotomy, and it may be performed easily and safely; but where adhesions are not formed the operation must be done with all the care and precautions employed in the most difficult abdominal section.

An incision from three to five inches long, according to the thickness of the abdominal walls, is made over the most prominent part of the abscess or where the pus is located by the aspirator needle. When the liver is reached the cavity of the abdomen should be completely walled off by moistened towels, or gauze pads, packed around the incision between the abdominal walls and the liver.

This protective wall of packing must be so thick and carefully crowded in between the organ and the parietes that the pus cannot possibly reach the healthy peritoneal tissues beyond. Then the abscess may be evacuated as far as possible by a good-sized trocar. When the bulk of the pus is removed the trocar-opening may be enlarged, the abscess cavity dosed out, and a search made for other purulent accumulations which may be contiguous to the mother sac. If a secondary abscess is found a pair of dressing forceps may be passed into it and the two blades be expanded with a pair of Tait's artery forceps passed between the blades of the first instrument, and the cavity opened. The partition wall should then be completely torn across by the fingers, introduced into the opening made with the forceps, the two cavities be thrown together, and thoroughly cleansed with peroxide of hydrogen, one to six, or the borosalicylic solution. The cavities of the abscesses may then be dried out, the packing between the liver and the abdominal walls carefully removed, and if any pus about the site of operation be found it must be disinfected and the wound in the liver sutured to the abdominal walls by a large, continuous silk thread. Then the organ may be packed loosely with sterile gauze or drained. For this purpose it will be well to introduce two half-inch rubber tubes, exercising caution not to omit the safety pins, else the pressure of the dressings from above will force the lower ends of the tubes into the soft hepatic tissue. As the cavities fill up, the tubes may be shortened from time to time, but not too often, as a small cavity may be left and cause further formation of abscess. (Fig. 619.)

In case the exploring needle shows that the pus or fluid is located near the junction of the upper and middle thirds of the liver it may be necessary to make an intercostal incision, or to resect about three inches of the tenth rib. With these exceptions the incision in the liver and all the steps are the same as in the operation below the ribs, unless the pleuritic cavity is unavoidably opened; if this happens it must be drained.

OTHER OPERATIVE MEASURES. Still another operation is indicated in abscess, or hydatid cyst situated in the upper part of the liver next to the diaphragm, and it must be carefully performed. An incision is made directly over the eighth rib in the axillary line, or over the most prominent part of the abscess or cyst. About three inches of the bone is resected, care being taken not to enter the thoracic cavity. An aseptic aspirator needle is introduced through the pleura, the thoracic cavity, and the diaphragm into the abscess or hydatid cyst. As much as possible of the

fluid or pus is drawn off, to prevent its escape through the needle-puncture into the thoracic cavity during the operation. The needle is left in the

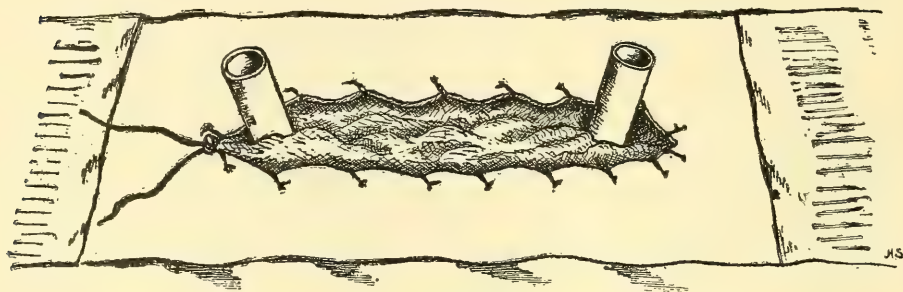


Fig. 619.

Rubber Tubes Inserted.

cavity and the costal pleura is opened to the full extent of the cutaneous incision. The costal pleura is then stitched by continuous silk suture to the diaphragm, being careful to insert the needle during the expiratory act to avoid injury to the lung. When the sutures have been passed and the thoracic cavity completely shut off, the diaphragm is incised, the remaining pus or fluid is evacuated, the cavity irrigated and dressed with good drainage, which completes the operation. In hydatid cyst there will probably not be adhesions to the diaphragm, therefore the sac should also be drawn through and stitched to the wound, else the fluid may gain entrance to the abdominal cavity.

CHAPTER V.

OTHER LIVER DISORDERS.

Hydatid Disease of the Liver.—This affection is quite rare, especially among children and adults after the age of forty. The youngest patient in which the disease is recorded was two years and one month. These cysts may be multiple, but generally only one is present. They are of slow growth, and may occupy any part of the liver.

SYMPTOMS. On account of their slow growth and because the distress is due to pressure the symptoms are slight or altogether absent until the disease is well advanced; even then the location of the cyst usually determines the character of the symptoms. If it is situated in the superior portion of the liver there will be pressure upward on the lungs, undue distension of the right chest, and an extended line of dullness with

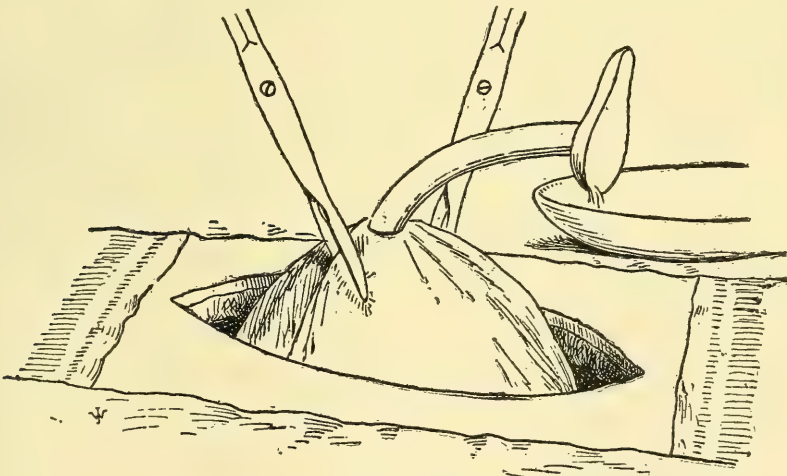


Fig. 620.
Drawing Sac through Abdominal Wound.

dyspnea. In this situation the disease may be mistaken for pleuritic accumulations, and cannot be differentiated from them except by the use of the exploring needle and the microscope. Again, the growth may press upon the gall-ducts and cause jaundice; upon the vena cava, producing serious passive congestion; or the disease may grow downward and develop a condition which closely resembles dropsy, or empyema of the gall-bladder. Sometimes the tumor fills the entire abdomen, and may be mistaken for an ovarian cyst. If proper care is taken, however, this mistake will not often be made; for palpation shows the growth to be continuous with the liver, and the dull percussion note extends uninterruptedly to that organ. Besides this the peculiar hydatid vibration may be heard when the ear is applied to the growth. The fluid is perfectly

clear, it does not coagulate on the application of heat, and the microscope shows the presence of echinococci, or hooklets, which are characteristic. The disease itself is painless, the growth is not sensitive, and the system is not affected by it unless from pressure or suppuration of the cyst.

TREATMENT. The old surgical treatment of this disease, consisting of puncture and withdrawal of a few ounces of fluid, aspiration of the contents of the cyst, injection of iodine, and electrolysis, all alike, should be abandoned for incision and drainage. When the aspirator is required it should be for exploratory purposes alone; then the needle must be very fine in order to prevent the escape of fluid into the cavity of the abdomen, and the surgeon should always be prepared to follow the puncture by abdominal section. When the sac is reached it must be tapped, the fluid discharged, and the sac drawn through the abdominal wound. (Fig. 620). After it has been incised to the length of the parietal incision and well cleansed with some antiseptic solution it must be stitched to the abdominal wall, as described under the treatment of abscess of the liver and tubercular peritonitis.

Simple or Dermoid Cysts.—These growths, when found, are amenable to the same treatment as hydatid cysts.

Wounds and Rupture of the Liver.—These injuries are of every conceivable nature, from punctures of broken ribs, gunshot or bayonet wounds, to the most extensive and indescribable ruptures. If the violence is of a certain character the rupture may involve the inferior portion of either the right or left lobes, and extend completely through them. In other cases the superior, anterior or posterior surfaces may be lacerated slightly, or the rent may even separate the liver into several fragments. The injury may be stellate, superficial or deep, or the organ may be crushed, owing to the nature of the accident.

SYMPTOMS. In gunshot or punctured wounds of the liver there is not often marked shock, and unless the patient is weakened from hemorrhage the symptoms are not usually alarming until inflammatory processes develop.

In extensive rupture shock, or even collapse, is very pronounced, and the patient may die from such cause within a short time. For obvious reasons the larger vessels are rarely torn across, consequently death from sudden hemorrhage is unusual. In case the wound is situated in the superior-posterior portion of the liver blood may accumulate in sufficient quantity to crowd the organ upward and forward, causing bulging of the chest wall, with an exaggerated line of dullness and dyspnea. Where the patient survives for a few days the blood and inflammatory products may produce sufficient fluid to cause dullness on percussion in the flanks.

Other organs are frequently contused or lacerated when the liver is injured, which more or less masks the symptoms; yet, where the injury to the liver is extensive, shock or even collapse is marked. Restlessness is present at first but soon gives way to utter prostration, and there is great pallor of the whole surface, which may be bathed in cold perspiration. Respiration is difficult, accompanied by long sighs, and there is a small, feeble, rapid pulse. There are also thirst, abdominal pain and tenderness, a sensation of faintness, nausea, and usually vomiting. If the patient lives a few days there may be itching, jaundice, and even abscess of the liver, with its symptoms.

TREATMENT. Experience in abdominal surgery shows that there is no reason why punctured, incised, or lacerated wounds of the liver should not be treated on the principles that govern surgeons in the management of similar conditions of other abdominal viscera. When the organ is wounded the abdomen should be opened, cleansed, and the hemorrhage arrested. In incised or lacerated wounds this may best be accomplished by large sheep-gut sutures passed at considerable distance from the wound edges, carried deeply through the substance of the liver, and tied down with only sufficient force to hold the wounded surfaces together. In case fragments of the liver hang by more or less firm attachments they should be removed or replaced in their normal relations and sutured at the discretion of the surgeon. If the hemorrhage is free at first from the lacerated surfaces it will soon subside, especially if gauze pressure is maintained for a few minutes. When this does not succeed and the wound cannot be closed the cavity

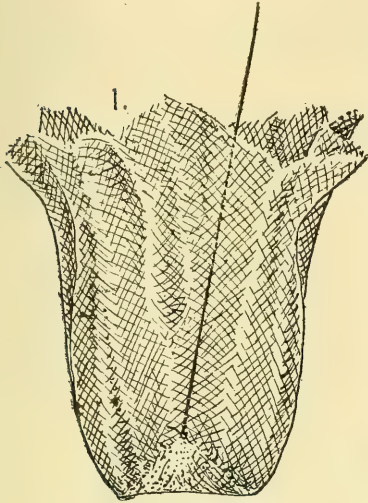


Fig. 621. Gauze Tampon.

may be packed with iodoform gauze in the following manner:

A single thickness of this material, fourteen inches square, is tied with a silk thread at its centre, grasped at this point with a pair of bird-stuffing forceps and carried down into the cavity to be packed. (Fig. 621). This square piece of gauze is left with its centre in the wound and its edges and thread hanging out of the abdominal incision. A roller of iodoform packing seven yards long and two and one-half inches wide, is next called into requisition, the square piece of gauze previously carried into the wound is packed up to a point a little above the level of the cavity or rent, and the iodoform gauze is cut off so as to project a foot or so beyond the abdominal incision. (Fig. 622). The edges of the square piece of gauze are gathered around the strip used as packing and the wound is neatly closed about them, though not too tightly. This packing not only acts as a successful hemostatic but also as a most excellent capillary drain. A good absorbent dressing is placed over it, and, within from two to three days all the gauze may be safely drawn out; first

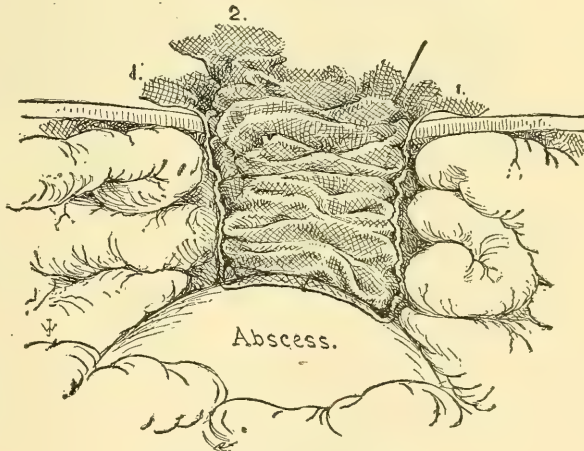


Fig. 622. Tampon in Situ.

the strip of packing, then traction on the string withdraws the square piece first introduced, turns it wrong side out, and enables the surgeon to remove it with ease.

Resections of Portions of the Liver.—It is only in certain favorable conditions, where the part to be removed is long and pendulous, that this may be practiced. Generally the portion of the organ to be excised is sutured to the abdominal wound, or retained by pins; then the part is removed by the knife, the cautery, or the elastic ligature, and the stump allowed to granulate over as in hysterectomy.

Floating Liver.—This condition is exceedingly rare, but well authenticated cases are recorded. The organ shifts its position to accommodate itself to the attitude of the patient. When erect it gravitates to the pelvis, and closely resembles pelvic tumor; but the sharp and characteristic borders of the liver, together with its absence from its normal position, quickly enable the surgeon to make a correct diagnosis. Its treatment consists in efforts to retain the organ in its normal position, but these usually fail, and unless some operation can be introduced to correct the anomaly the condition will be placed in the category of incurable displacements.

CHAPTER VI.

SURGERY OF THE GALL-BLADDER.

Cholelithiasis.—The formation of biliary calculi is more common among women than men, and is oftenest observed between the ages of forty and sixty. They develop in both the liver and gall-bladder, although some surgeons believe the nuclei are always formed in the liver and that

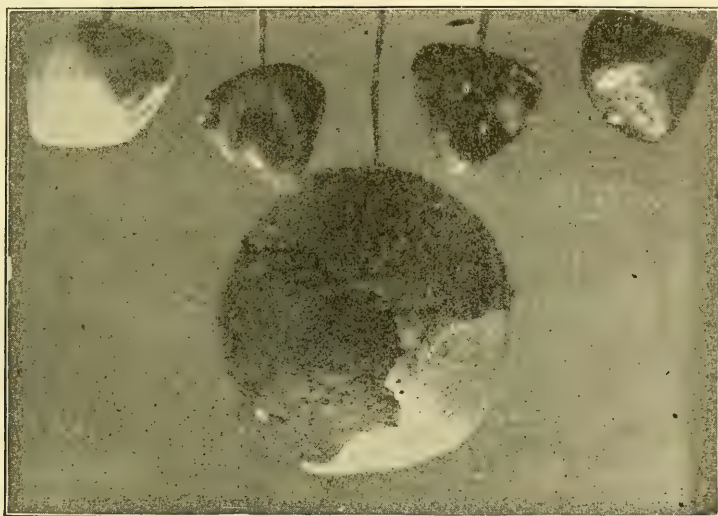


Fig. 623. Biliary Calculi. Largest Measuring 2 7-8 Inches in Circumference.—Ellis.

they then pass to the cystic, hepatic or common ducts, as well as the gall-bladder, where they accumulate. There may be a large solitary stone which fills the entire bladder, or from two to six smaller ones; (Fig. —.) or the cyst may be distended with hundreds of diminutive calculi.

Cholelithiasis is the cause of fully ninety-five per cent. of all cases of obstruction of the ducts of the gall-bladder; but it must not be forgotten that catarrhal or cicatricial stricture, accumulation of liver-flukes, hydatid cysts, or cancer of the head of the pancreas are also occasional causes.

COURSE.—Irritation and infection from these obstacles may develop local peritonitis, and the biliary apparatus be occasionally united to the tissues around it and concealed in a mass of adhesions which it is difficult or even impossible to separate. Again, several calculi may block the hepatic, common or cystic ducts, and, in rare cases, produce fatal shock before cholemia is established. In others, inflammation, ulceration, or even gangrene of the gall-bladder develops, and sepsis quickly terminates life.

In other cases the calculi ulcerate their way through the tissues into

the abdomen, where they may be encysted or cause fatal peritonitis; or they may reach the intestinal canal and be discharged from the rectum, or lodged in the alimentary passage, and induce fatal obstruction if not removed. Again, they may cause abscesses which discharge in various directions, and give rise to abdominal and visceral fistulæ, along the tracts of which, in different places, calculi may be found, even in the lungs or urinary bladder.

When protracted obstruction of the hepatic duct takes place the liver is greatly enlarged, intense jaundice develops, and if the impediment is not removed it goes on to cholemia and death. On the other hand, if, from the above causes the cystic duct only is occluded for a considerable time, or permanently, jaundice will not appear, but fluid accumulations will certainly distend the cyst of the liver. If they are serous in character the condition is known as dropsy of the gall-bladder; if they are purulent it is diagnosed as empyema.

Empyema of the Gall-Bladder.—In this disease the internal wall of this viscus suppurates, the fluid becomes purulent, and in some cases thick, greenish pus is formed. Inflammatory thickening may occur over certain areas, while ulceration develops in others. This latter process weakens the walls of the gall-bladder and prevents large accumulations, as even moderate distention causes perforation and sudden death.

Dropsy of the Gall-Bladder.—In this disease there is almost no limit to the degree of distention of which this viscus is capable. In fact, it may enlarge until it completely fills the abdomen, when it becomes very difficult to make a differential diagnosis between dropsy of the gall-bladder and hydatid or ovarian cysts. On the other hand, when the bladder is only slightly enlarged it may resemble floating kidney, pyonephrosis or hydronephrosis. The movement of the growth upward and downward synchronously with the respiratory acts, the inability to press the tumor back into the normal site of the kidney and the fact that it does not elude the grasp, like floating kidney, usually serve to differentiate it from the latter disease. There is no way to make a positive differential diagnosis between adherent, distended gall-bladder, hydronephrosis, pyonephrosis, abscess, and circumscribed peritonitis in this region, except by the exploratory incision.

Treatment.—When, during the passage of biliary calculi, there is imminent danger from either exhaustion or collapse the surgeon must not hesitate to open the abdomen and remove the obstruction. The technique to be observed is sufficiently described in the following pages, which comprise the surgical treatment of cholelithiasis and its sequelæ in three operations: Cholecystotomy, cholecystenterostomy, and cholecystectomy.

CHOLECYSTOTOMY. This consists in abdominal section, either parallel with the ribs or to the outer border of the rectus abdominis muscle on the right side, through the linea semilunaris. The latter site is preferable. When all hemorrhage has been arrested the peritoneum is opened, the gall-bladder exposed, walled off with gauze pads and tapped. When a convenient amount of fluid has flowed off two pairs of artery forceps are applied to the relaxed sac on each side of the canula and transverse to the parietal incision. The gall-bladder is now drawn

through the wound, the canula removed, its opening enlarged, all fluid sponged out and the concretions extracted with the fingers, forceps or lithotomy spoon. If calculi are impacted in the cystic duct the ingenuity and skill of the surgeon may be taxed to dislodge them. When this is done a careful search must be made for obstruction to the hepatic or common ducts, and here, if calculi are found, even greater difficulties beset the operator. The concretions probably cannot be readily extracted and it may be necessary to crush them with the fingers or padded forceps and crowd the debris onward into the duodenum. If the duct cannot be freed in this way and the liver is not too much enlarged from the obstruction to prevent it the common duct may be incised, the foreign body removed and the wound carefully sutured. The sac is again cleansed with a peroxide of hydrogen or boro-salicylic solution, and if too redundant a portion is cut away and the remainder carefully stitched to the abdominal wall. The cavity should be drained with one or two half-inch rubber tubes, and iodoform gauze packed loosely around them, the whole covered with a copious dressing retained with a many-tailed flannel bandage.

The biliary fistula which sometimes follows this operation may readily be closed. The cutaneous border of the cicatrix and the gall-bladder down for a quarter of an inch is freshened completely around the fistula, the jetting vessels are tied, and the freshened surfaces brought together with silk-worm gut sutures. Union quickly follows and a good result is usually attained. The operation should not be performed where the common duct is known to be occluded. Fig. 624.

CHOLECYSTENTEROSTOMY. Where the common duct is occluded, from stricture or other causes which cannot be relieved it becomes neces-

sary to establish a fistulous opening between the gall-bladder and the duodenum by means of the Murphy button. If the liver has not become too much enlarged from the obstruction this operation may be quickly and conveniently performed. The duodenum, which is the

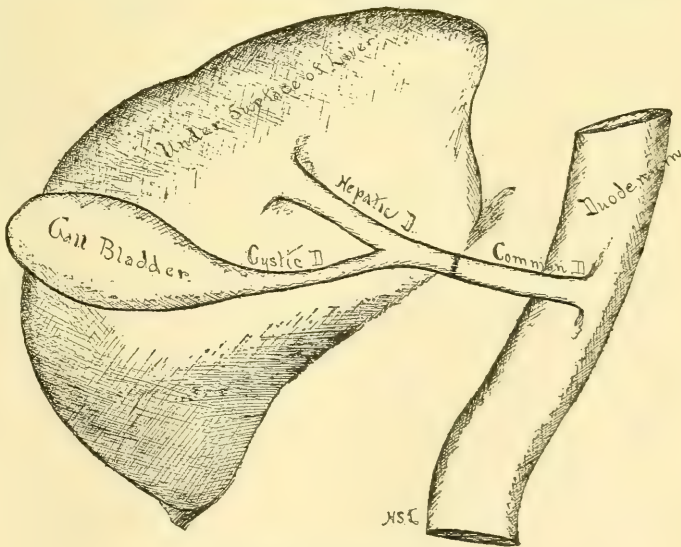


Fig. 624. Anatomy of Parts.

largest of the small intestines and which has no mesentery, should be recognized as usually adjacent to the gall-bladder. The fluid should now be drawn off from the cyst, and its walls relaxed. A piece of fine silk is threaded on a straight needle, and three running stitches are taken in the viscus. The

needle is now turned around and three other stitches are taken back, parallel and opposite to the first ones, and one-quarter of an inch from them. Fig. 625. The duodenum is prepared in the same way and an incision is made between the two rows of sutures in each organ just large enough to admit next to the smallest size of the Murphy buttons. The threads are now tied around the necks, and the halves of the button pressed together with only sufficient force to insure the retention and adhesion of the apposing surfaces of the peritoneum. Fig. 627.

CHOLECYSTECTOMY. This operation has a narrow field of usefulness. It should be performed only where the common duct is patent, and the function of the gall-bladder either from extensive wounds, atrophy,

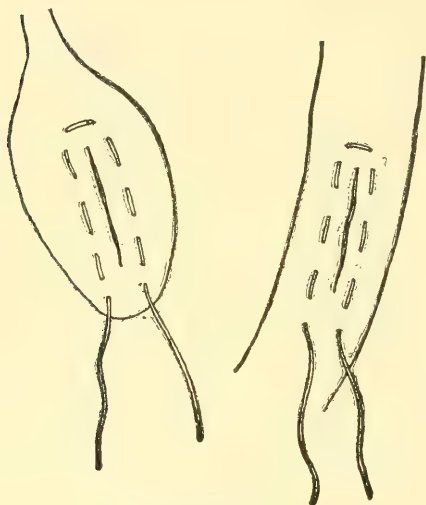


Fig. 625.
Stitches on Viscus.

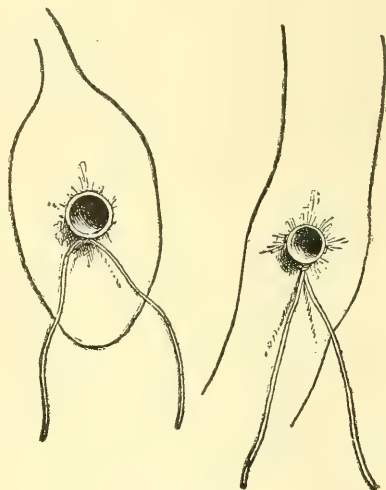


Fig. 626.
Murphy Buttons.

stricture or ulceration is hopelessly destroyed. It consists in the separation of the gall-bladder from the liver by a sponge, assisted occasionally by the division of a few bands with the scissors. Hemorrhage is usually arrested by sponge pressure; but if there are small jetting vessels they must be tied by sheep-gut ligatures. When the bladder is loosened and is only attached by the cystic duct, two strong silk ligatures are tied about the upper end of this structure, the first within an eighth of an inch of its origin, and the second about one-half inch below it toward the gall-bladder, the duct being severed between the two threads. The tied end of the duct should be rendered aseptic by means of a dossil dipped in a strong sublimate solution, and then overcast by a continuous silk suture, so as to bring the lips of the duct together.

Wounds of the Gall-Bladder.—When this viscus is punctured or ruptured the condition is serious, yet the extravasation of bile into the abdomen is by no means always fatal, even when the accident is not followed by immediate operation. Shock and localized pain may possibly

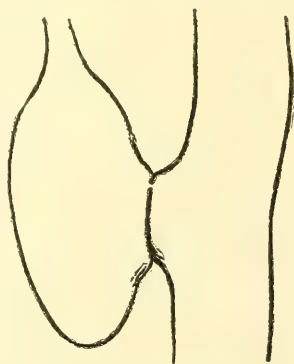


Fig. 627. Adhesion by
Murphy Buttons.

direct the attention to the gall-bladder, but the injury cannot positively be made out except by the introduction of an aspirator needle, or by the exploratory incision.

If several hours have elapsed since the infliction of the injury the aspirator needle will probably show the presence of free bile in the abdomen, when this cavity should be immediately opened through the *linea semilunaris*, just below the ribs, and the injury treated according to the needs of the case. If the viscus is so situated that the rent or puncture can be sutured to the abdominal incision this should be done. If it is not the surgeon may choose between *cholecystenterostomy* and *cholecystectomy*. The latter should not be performed, however, unless the common duct is patent or can be made so.

When any one of these operations has been completed the abdomen should be flushed out with boiled water which has been allowed to cool to 110 degrees Fahr. If this, for any reason, cannot be done through the opening in the *linea semilunaris*—and it probably cannot on account of faulty drainage—another incision should be made between the pubes and the umbilicus, and the abdomen quickly and thoroughly flushed, drained and closed.

CHAPTER VII.

CYSTS OF THE PANCREAS.

Etiology.—Cysts of the pancreas are generally caused by obstruction of its excretory duct, usually by stricture or calculi and retention of the pancreatic juice and catarrhal products. They are more common in men than women, their size and growth are quite variable, and they have been observed only in adults. In some instances pancreatic cysts develop rapidly, have thin walls, and fluctuation is very marked. In others they increase in size slowly, and their walls are thick and calcareous. They are usually well defined, situated between the lower border of the ribs and the umbilicus, and have a tense or firm feel.

Diagnosis.—The diagnosis is not easy. Fluid drawn from the tumor by the exploring needle is usually of a pea-green color, though it may be of almost any other shade, and totally without characteristic appearance. Again, there is considerable admixture of pancreatic juice, which, if in sufficient quantity, will turn starch into grape sugar and partly emulsify fat. If there is pain in the region of the pancreas, if digestion is impaired, and there is a peculiar earthy coloration of the skin, pancreatic cyst may be strongly suspected, especially if the patient is found to pass fatty stools. There probably will be more or less doubt as to the nature of the disease, and an exploratory incision should be made, with sufficient preparation to carry out appropriate treatment, no matter what form of growth is encountered.

Treatment.—Extirpation, though occasionally successful, ought not to be attempted, as incision and drainage save most cases. An incision should be made over the most prominent part of the swelling, the cyst punctured with a trocar, and, as the fluid escapes, catch-forceps should be applied to the sac, which is drawn through the abdominal wound. It may then be incised, washed out, and the calculi in the duct sought for and extracted. If any portion of the sac can be cut away without causing tension this should be done, when it is to be stitched to the abdominal wound and the cavity carefully drained or packed until it fills up and cicatrizes over. It is possible that in case the duct is strictured a communication might be made in the duodenum, to advantage, by means of the Murphy button.

Abscess of the Pancreas.—This is generally impossible of diagnosis, and almost all cases have ended fatally. If it is recognized it should be incised and drained, though probably on account of the depth at which the abscess is situated it will be necessary to do the operation in two stages. First, the abdomen is opened, the face of the abscess is exposed, and gauze is packed from its surface up through the abdominal wound. At the end of from four to six days, when plastic peritonitis has walled off the cavity of the abdomen from the gauze, it should be removed, the abscess incised and drained. Or, if it is situated near the tail

it might be more readily reached through the back. However, the aspirator will decide which course to pursue.

Wounds of the Pancreas.—These are met with only in open wounds of the abdomen or when it is explored for other injuries. In punctured or lacerated wounds hemorrhage should be arrested by sutures. Care must be taken to pass them at some distance from the borders of the rents or incisions, and that only sufficient tension is put upon them to nicely hold the parts in apposition. If a portion of the pancreas has been extensively injured and conditions are favorable it may be removed.

Cancer of the Pancreas.—Cancer of the pancreas is rarely diagnosed in time for surgical treatment, but there may possibly be cases in which operation is justifiable.

SECTION XXII.

HERNIA.

CHAPTER I.

GENERAL CONSIDERATIONS.

Definition.—A hernia is a tumor formed by the escape of a part or the whole of any viscus from its natural cavity; thus hernia cerebri, hernia pulmonum and hernia abdominalis. The term, however, is commonly restricted to the protrusion of some abdominal or pelvic viscus through the abdominal or pelvic walls, and it is with this limitation that it is here used.

Location.—Abdominal hernia usually occurs at some natural opening which has become dilated, and the protrusions are designated accordingly; inguinal hernia, crural hernia, umbilical hernia, obturator hernia, hernia sacro-sciaticus. When occurring at other points, as through the muscular or musculo-tendonous parietes they are termed ventral hernias. There is no part of the abdominal parietes not inclosed by bone through which a hernia may not take place, and there is no abdominal viscus which has not been found protruded. In the greater number of cases the intestines and omentum form the contents (entero-epiplocele); but sometimes the omentum alone (epiplocele), the intestine alone (enterocele), the bladder (cystocele), the liver (hepatocele), the stomach (gastrocele), etc.

Causes.—A large proportion of the cases of hernia make their appearance in infancy, or early adult life, and are probably preceded by a condition resulting from arrested development, delaying the descent of the testes, and retarding the complete formation of the transversalis, internal oblique, and cremaster muscles, and thus preventing or delaying the closure of the fetal openings at the inguinal or umbilical regions. It is a noticeable fact that infants the subjects of hernia are almost invariably the subjects also of tight foreskins, small preputial orifices, have hydrocele of the cord, or other evidences of mal-development. When the development has been completely arrested the child has a congenital hernia, but in the largest proportion of these cases the development has been only retarded and the child is born with a patulous canal which predisposes it toward the occurrence of rupture. The testicles in early fetal life are abdominal organs, and are situated in the lumbar region near the kidneys. At or about the fifth month they commence their descent toward the scrotum. As they descend they push before them a prolongation of the peritoneum, by which they are partially invested, and for

some time after their entrance into the scrotum a communication exists between the testicular sac and the abdominal cavity. In the normal process of development the lower portion of this scrotal sac becomes divided from that above and forms the tunica vaginalis propria testis; the upper portion, the tunica vaginalis of the cord, becomes obliterated, remaining only as a firm band, and the opening through which this descent takes place becomes closed. This evolution may be arrested at any period of progress, leaving the entire canal open, leaving the ventral orifice open, with the testicular orifice closed, or leaving both orifices closed with the funicular portion of the vaginal process remaining as a tube. The greater opportunity for congenital malformation of these parts in the male is undoubtedly the cause of the greater predisposition of the male to the occurrence of hernia, being, according to Croft, three to one. According to Richter an abnormal elongation or low attachment of the mesentery is an important predisposing cause, by allowing the mesentery, omentum, and intestines to press with undue force upon the inguinal canal and femoral opening. The importance of this condition is difficult to estimate. Indeed it is often a question whether the elongation or relaxation often found in those afflicted with hernia is a cause or a consequence of the hernia. Abnormal elongations are sometimes found in persons in whom no hernia exists. On the other hand it is known that if an opening exists, normal attachment of the omentum and mesentery will not prevent the formation of hernia, as shown in the prompt formation of these protrusions after accidental wounds. Again, persons with a hernial sac are troubled more with a descent of the hernia when out of health than at other times, and persons with relaxed frames are more subject to hernia as they advance in life. It seems probable, then, that if the abdominal parietes are normal the pressure of the abdominal contents is not sufficient alone to produce hernia; but, if the natural orifices are weak, this pressure may prove an important element in the formation of a hernia. Certain occupations demanding unusual strain are predisposing causes of some importance. Sailors, blacksmiths, carpenters, athletes, who practice inordinately the lifting of heavy weights, and laborers generally are more liable to rupture than those of more sedentary habits. Rowers and boxers are, notwithstanding their great development, frequent sufferers. Weakening of the abdominal walls from any cause, abscess, pregnancy, tumors, or excessive straining, as in coughing, the act of defecation or the efforts of parturition, may be the cause of a rupture of the parietes and the formation of a hernia.

General Anatomy.—With few exceptions all hernias consist essentially of some portion of an abdominal viscus covered by a process of peritoneum, a certain number of fasciæ, and the integument. The first of these coverings is termed the sac. It may be wholly or partly absent in protrusions of the cecum, or bladder—which in normal conditions are only partly invested by the peritoneum—in certain congenital umbilical hernias, and in hernias resulting from abdominal wounds.

The sac has a neck, body, mouth and fundus. The neck is the narrow constricted portion which occupies the aperture of escape; the mouth, the point of communication with the abdominal cavity; the body, the part which surrounds the protruded viscus; the fundus, the lower rounded part of the body of the tumor. Two forms of hernial sac are

found, the congenital sac (see causes), the unclosed prolongation of the peritoneum which descended with the testes, and which is only found in what is known as congenital hernia, and the acquired sac. This latter form, when it first escapes from the abdominal cavity, may be replaced, but in time it becomes adhered to the parts with which it lies in contact and its replacement becomes impossible. During this early stage the sac is thin and translucent, but as adhesions form, being the result of more or less irritation, it becomes tougher and more indurated and may even be the seat of calcareous degeneration. The neck of the sac also takes on many changes. At first it is almost as wide as the body itself, but soon it becomes puckered by the constriction of the opening through which it escapes. While the sac is returnable to the abdomen the neck of the sac itself produces no constriction upon its contents, and the puckering, upon the return of the sac to the abdominal cavity, readily disappears; but as the sac becomes adherent to the subjacent tissues the puckerings become permanent, and an indurated and firm vascular ring is formed, which may of itself exert constriction upon the contents of the sac. In old cases this may be a source of more danger and difficulty in reduction than the abdominal aperture. The opening which is at first elongated, especially in the inguinal region, may become circular and often quite enlarged, and if the hernia is very large the opening may become displaced by the weight of the hernial contents; thus in an oblique inguinal hernia the internal ring may be brought down to a point just behind the external ring, and make the diagnosis of these different varieties very difficult.

General Symptoms.—The first symptom of a hernia is the sudden appearance of a tumor at one of the natural openings of the body, as at the inguinal, femoral or umbilical. The tumor shows itself on assuming the erect posture, is made more tense by coughing or lifting, and, if reducible, disappears on assuming the recumbent posture. The swelling, which is smooth and uniform, conveys an impulse when the patient coughs, which may be felt if the tumor is firmly grasped by the fingers. The impulse is less if the hernia contains omentum than intestine, the feel of the former is less elastic, and upon percussion has a duller sound than when the hernia contains bowel. In recent cases the swelling can usually be reduced by taxis, and when so reduced can be prevented from recurring by placing the fingers over the aperture through which the escape was made. As soon as the finger is removed the tumor reappears. If the hernia contains intestine a creaking or gurgling sound (*borborygmus*) may be heard by the ear, or recognized by the finger as the contents of the hernia pass into the abdominal cavity.

Pain may or may not be an accompaniment of hernia. If the hernia is produced as the result of violent exertion, sharp pain is felt when the tissues give way, and a dull aching pain during the distension of the opening. In other instances the patient is hardly conscious of its production, but suffers from a dragging pain in the back, or near the umbilicus. Other symptoms of a general nature, flatulence, uneasiness after eating, nausea, vomiting, colicky pains and constipation, are often present. No one of these signs can be relied upon to the exclusion of the others. Swellings, the result of contusions, or even abscesses when first brought to the attention of the patient, or any accumulation which can be pressed

upon by the abdominal muscles may become more tense upon standing or coughing, and an enlargement due to varicocele, or psoas abscess, may disappear upon lying down, or be easily pressed back into the abdominal cavity. The history of the case with the concurrence of the more important signs, will usually indicate the trouble present. In doubtful cases a careful section may be demanded, especially if the symptoms of obstruction are present.

CHAPTER II. VARIETIES.

Reducible Hernia.—A hernia, the contents of which can be returned into the abdominal cavity, either with or without manual pressure, is called a reducible hernia. In a few recent cases the sac (peritoneum) may be returned, but in the majority of cases it cannot. The term, however, applies whether the peritoneum is or is not returnable. Usually this reduction may be attained by assuming the recumbent posture and elevating the hips, being accomplished by the force of gravity. It may be aided by forced expiration, by flatulent motion of the intestine, or by the compressive action of the dartos or cremasteric fibres, stimulated by cold water, air or ether. Finally the pressure exerted by the finger may supply the necessary force (taxis). For treatment see Special Forms.

Irreducible Hernia.—A hernia, the contents of which cannot be returned into the abdominal cavity, except by operative measures, but in which there is no obstruction to the passage of feces, or the circulation of blood through its vessels, is an irreducible hernia. This condition may be the result of several causes: 1. Constriction of the neck of the sac, due to a slow process of induration, reducing the size of the aperture while the body of the hernia continues to increase. If at the same time the neck of the hernial contents (if omentum) atrophies, any attempt to push up the mass causes it to double upon itself, and present an effectual barrier to the return of the protruded parts. 2. The enlargement of the omentum or mesentery by the deposition of fat, or the development of glandular or fibroid changes which result in the matting together of the same in a conical mass. 3. The formation of adhesions between the contents of the hernia and the interior surface of the sac.

Irreducible hernia may exist for a long time without noticeable inconvenience, especially if the hernia is omental; but it is usually attended by more or less dragging pain in the abdomen and with disturbance of the digestive functions, as flatulent distension, nausea, vomiting and constipation. It constantly tends to become larger, and is always exposed to the risk of becoming inflamed, obstructed, or strangulated. One pronounced danger, if the condition is permitted to exist (White) is the possible permanent loss, in enterocele, of the power of peristalsis in the protruded bowel, which may prevent even operative measures from being effective when obstruction or strangulation occurs.

GENERAL TREATMENT OF IRREDUCIBLE HERNIA. Before the advent of antiseptic methods, and when operative measures were rare except in strangulated hernia, it was the common advice (still given in many text books) to refrain from all operations and depend upon palliative measures, because of the great hazard involved in opening the sac and dissecting away adhesions. In patients whose age and physical condition prohibit an operation, or in which the surgeon is assured that the hernia is an enterocele, and that such changes have taken place in the intestine that

return to the abdomen is impracticable, these measures may still be adopted. Let the bowels be kept regular by careful diet and the use of the indicated remedy, aided if need be by enemata, and let the hernia be supported by a suspensory bag. If obstruction threatens copious enemata of olive oil should be frequently administered and hot compresses applied to the tumor. The very low rate of mortality under modern hernial operations warrants the advice that all recent cases of irreducible hernia should be treated by open incision and return of the hernial contents; that all cases of omental hernia should be treated by incision of the sac and excision of the protruded omentum; that all cases of enterocele are best treated by incision of the sac, separation of adhesions, and return of the protruded bowel. The exceptions are given above. (See Special Hernias for operation.)

Strangulated Hernia.—A hernia the contents of which cannot be returned into the abdominal cavity and whose neck is so constricted that the circulation of blood in its vessels is obstructed, its nerves paralyzed, and, in cases of enterocele, the passage of secretions and feces prevented, is a strangulated hernia. Of the causes producing this condition two are most frequently operative. First; The sudden protrusion of an additional amount of intestine or omentum into an irreducible hernia, or the sudden descent of a hernia, long retained by a truss, into a sac which has commenced the process of contraction. Second; The use of violent, long-continued and ill-directed taxis, or the application of a truss without the proper return of the hernia, in consequence of which the viscera become swollen or inflamed. It is possible, also, that inflammation about the neck of the sac, of the sac itself at the abdominal aperture, the escape of the viscera into the sac when they are already engorged or inflamed (as when a patient is suffering from diarrhea), or the gradual arrest of the venous circulation by the weight or pressure of an old hernia may be productive of this condition. Occasionally a hernia the result of violent effort, as running, lifting or jumping, becomes strangulated, when first produced, by the firm contraction of the abdominal muscles.

SEAT OF OBSTRUCTION. As may be judged from the causes operative in this condition the seat of obstruction is usually at the neck of the hernia, external to the sac, in acute cases which are the result of violent rupture of the abdominal walls and in cases due to inflammation of the tissues surrounding the neck; in the neck of the sac in old cases, in maltreated cases, and in cases of peritoneal inflammation; and in the body of the sac in cases in which a recent hernia has been super-added upon an old one. More rarely the constriction may be in the hernial contents, due to the intestine being caught in an omental fold or pocket, or bound down by an organized band of lymph.

PATHOLOGICAL CHANGES. The first effect of strangulation is the production of congestion in the protruded part, the result of the arrest of the venous circulation. Then the bowel becomes swollen and engorged, loses its pink color, and takes on a dark red and finally a purplish appearance. In the meantime the fluid in the sac increases and patches of lymph, the result of inflammatory action, appear on the peritoneal covering of the bowel. In time this membrane loses its natural lustre, becomes soft and friable and either takes on a greyish-black color

or is covered with greyish-yellow spots. Gangrene has now taken place. Fecal extravasation into the abdominal cavity or into the sac follows. In a large percentage of cases inflammation has so united the gut to the neck of the sac that fecal matter cannot enter into the abdominal cavity. If the extravasation is not relieved the sac itself may become gangrenous, the skin ulcerate, and a fecal fistula be formed. Accompanying these changes in the bowel, if the strangulation has persisted for any length of time, is inflammation of the abdominal peritoneum, which soon becomes diffused and attended by effusion of serum, followed by deposition of lymph and, finally, formation of pus. If the strangulated part be omentum the changes are usually less rapid, but the venous engorgement is more pronounced and the effusion of serum into the sac increased. Hemorrhage into the sac is not an uncommon feature, not due so much to any difference in the pathological changes from those that take place in strangulated enterocele as to the fact that the less painful character of the omental hernia often leads to more prolonged and violent taxis.

SYMPTOMS. In a hernial tumor which cannot be reduced obstinate constipation and vomiting are the common symptoms of strangulation. One or more constipated movements may take place after the establishment of strangulation, but they are usually attended by tenesmus and straining. If the hernia be omental constipation may be present, but it is not extreme. If the evacuations are large the strangulation is probably some distance above the large intestine. If the strangulation is complete vomiting occurs very early and is attended by severe pains. The higher the strangulation the earlier the vomiting in the sequence of symptoms. In other cases the patients suffer from griping pains, the abdomen becomes slightly distended, flatulent eructations and rumbling of gas harass them, and vomiting occurs. The matter ejected is first the unchanged food, next bile or chyle, and finally a dark-brownish fluid having a decidedly fecal smell. The pain increases in intensity and is commonly referred to the region of the umbilicus. The temperature of the patient in the earlier stage is usually normal, but as the disease progresses it may rise above normal at night and fall below in the morning. At the same time the pulse is usually accelerated. In the later stages of the disease the temperature is often persistently below normal and accompanied by a rapid pulse and quick, shallow respirations. When gangrene takes place the pain often ceases but the emaciation and exhaustion continue. The face becomes pallid and shrunken, the breath cadaverous, and the patient succumbs to the disease at a period varying from a few days to several weeks. There are many variations from the symptoms narrated above. Indeed the patient may not be aware (especially in some forms of femoral hernia) that he has a hernia, or that it is strangulated, so slight are the symptoms. Again, in cases of acute strangulation, in young people, or in cases the result of violent exertion, the symptoms may be acute from the start, symptoms of peritonitis overshadowing all others. In these cases the pain and distress appear promptly and rapidly become intense. The patient lies on his back with the knees drawn up and the abdominal muscles rigid. The face is pale and anxious, the respirations are rapid and shallow. The pulse is soft and compressible at first and rarely exceeds one hundred and

twenty. The temperature ranges from 102 degrees to 105 degrees. If unrelieved the abdomen becomes distended, the retching increases, the thirst becomes intense, hiccough sets in, and the patient dies in from thirty-six to forty-eight hours.

DIAGNOSIS. In all cases in which there are symptoms of obstruction of the bowel as evinced by obstinate constipation, persistent vomiting and severe abdominal pain, the usual sites of hernial protrusions should be carefully examined, and an accurate history of the present attack and possible former attacks obtained. If no protrusion is found and yet a history of hernia is obtained the probability is that so small a knuckle of intestine is caught in the deeper structures that it can not be felt. This condition is not infrequently met in fleshy females. In such cases the probabilities are sufficient to warrant an investigation by incision. If a hernia is found which cannot be reduced and no other conditions are found which will account for the symptoms of obstruction a more positive diagnosis may be made. In such cases a differential diagnosis must be made between local peritonitis, appendicitis, the vomiting of pregnancy, and intestinal obstruction which may accompany an irreducible hernia, but not be caused by it. A careful inquiry into the history of the attack will be sufficient in most instances to decide this question, aided by some local symptoms. In coincident peritonitis, or appendicitis, the point of tenderness may be at some distance from the hernial sac. The vomiting of pregnancy is not stercoraceous, and there may be an absence of constipation. In intestinal obstruction due to other causes a positive diagnosis may be impossible. If two or more hernias are found and one is irreducible it is probably the offender. If both are irreducible there will be more tenderness about the one which is the seat of constriction, or it will be harder or more tense.

An inflamed, undescended testicle, an inflamed inguinal gland, a fatty tumor, a hydrocele of the cord, a sarcocele accompanied by thickening of the cord, a pelvic abscess may all simulate strangulated hernia; but the differential diagnosis can be better discussed under certain special forms of hernia.

PROGNOSIS AND TREATMENT. The prognosis in strangulated hernia depends largely upon the line of treatment adopted. If unreduced, either by manipulation or operation, the patient almost invariably dies. In acute cases gangrene may occur in a few hours and death in less than forty-eight hours. In chronic cases the patient may live a week or ten days, and in very rare instances the bowel has become gangrenous, the sac and skin sloughed, an artificial anus been formed spontaneously, and the patient has recovered. All measures of relief should be adopted without delay. Time is an important element.

TAXIS. The first duty is the return of the strangulated part to the abdominal cavity, by taxis if possible; if not, then by herniotomy. The mode of taxis varies according to the form and location of the hernia, special directions for which can only be given under the head of special hernias, but in every case the surgeon must act on the theory that in all probability the protruded part is congested or inflamed, or else it would not be strangulated, and that any rough or violent handling is liable to increase the very danger most to be feared, viz: inflammation and gangrene. He should not be deceived in this regard by lack of com-

plaint on the part of the patient, for the sensitiveness of the patient is not always in proportion to the severity of the lesion, and patients vary much in their ability to bear pain without complaint. If the patient is seen early an attempt may be made at reduction without an anesthetic. The bladder having been emptied, the patient should be placed upon his back with his shoulders and hips slightly elevated and his thighs abducted and flexed. The surgeon stands upon the right side and grasps the fundus of the tumor with his right hand and with the thumb and finger of his left hand fixes the orifice and neck of the hernial sac. By gentle pressure of the body of the tumor he squeezes out, if possible, the gases or fluid contents of the bowel; then drawing down the tumor a little in order to dislodge the hernia from the constricting neck of the sac, and at the same time drawing down the mesentery, with the thumb and finger directing the mass, so that it will not be pressed over the tendinous opening, with the right hand grasping the fundus he makes pressure in the direction of the hernial opening. The object is to return those parts first which protruded last. A gentle kneading, squeezing motion, aided sometimes by pulling the tumor down, and from side to side, and then pressing in the direction of the opening, is the most effective. The first evidence of success is a decrease in the size of the tumor, accompanied by a slight gurgling sound. If the tumor contains bowel continued pressure may soon result in the prompt return of the gut, which is accompanied by gurgling. If it contains omentum the return will be slower. If it contains both the former protrusion may return and the latter be irreducible. If gentle and intelligent effort does not succeed in from ten to fifteen minutes the patient should be apprised of his serious condition, all preparations should be made for herniotomy, an anesthetic given, and a second trial made under anesthesia. If this does not succeed herniotomy should be done at once while the patient is anesthetized. By this means the exhaustion of subsequent anesthesia is obviated, and delay is minimized.

Two causes have contributed to the great mortality of strangulated hernia, even with operation: too great delay and unskillful and violent taxis, more, probably, from the latter than from the former. I have never operated upon a case of strangulated hernia during the first twenty-four hours which has proved fatal, and I am firmly convinced that by prompt surgical treatment the mortality of this serious condition may be reduced to nothing. For this reason many of the old measures, dragging the patient almost by the heels, puncturing the intestines, the application of weights, venesection, inflation of the bowels and similar plans, all of which add new dangers to the inflamed hernial contents, are not advised. When it is considered that the operation properly made adds no risk to the patient and offers both life and permanent cure there is no excuse for unnecessary delay. If strangulation occurs in an old irreducible hernia, taxis should be made with great caution if at all. If the application of ice when the patient is full-blooded, or of heat when anemic, and a thorough emptying of the bowel by enemata do not relieve the symptoms, herniotomy should be made. If the gut has been strangulated for some time and if the integument is inflamed taxis should not be employed for fear of doing injury to an already inflamed and fragile organ.

STRANGULATION AFTER REDUCTION. If after the employment of taxis the tumor disappears but the symptoms of strangulation remain one of the following conditions may be present: The sac and contents may be pushed into the loose sub-peritoneal tissue, or between the abdominal muscles; the bowel returned may be gangrenous; paralysis of the bowel may exist (as the result of gangrenous peritonitis, or inflammatory deposits in the bowel itself as occur in old irreducible hernia); a second hernia may exist, or the bowel may have returned strangulated, being obstructed by some constricting band or by a ruptured sac. In all these cases abdominal section should be made and such means adopted as circumstances demand.

ADJUVANTS AND MEDICINES. Certain adjuvant measures are sometimes of service and may be tried in the absence of proper assistance or instruments, or when the consent to prompt operative means cannot be obtained. While occasionally serviceable there can be no doubt that the possible aid offered by these measures has often delayed the necessary operative measures, and thus lessened the patient's chances of recovery. The local application of cold is one of the most valuable of these measures. The patient is placed in the recumbent posture and the hips elevated. The parts may be then chilled by spraying with ether, or, if a spraying apparatus be not at hand, by pouring teaspoonfuls at a time from a height; or an ice bag (the surrounding parts guarded by flannel) may be left over the hernia for four or five hours.

In the meantime the appropriate remedy may be administered. As the results of clinical observations certain remedies have been recommended as efficacious in this condition. Of these *nux vomica* holds the chief place. It is indicated when the strangulation has been preceded by errors in diet, exposure to cold, when the respiration is labored and oppressed, and when the initial vomiting is black and bitter. Next to *nux* can be considered *aconite* and *belladonna*. The former should be employed when the pulse is full, hard and quick, the parts sensitive to pressure, and the patient's mental condition that of great anxiety and forebodings. Beside these *arsenicum*, *cocculus*, *lachesis*, *lycopodium*, *sulphur* and *veratrum* have been successfully employed.

The hypodermic injection of *atropine* has been used with success by *Rahn*. *Ergot* has been administered by the mouth and applied locally by *Planat*. Occasional reductions of strangulated hernia have occurred after the administration of opium 1st or *morphia*, but I am convinced that cases amenable to this form of treatment will always respond to the careful use of taxis under chloroform. The administration of *morphia* is to be condemned, as it disturbs the stomach, disguises dangerous symptoms and lulls the patient into a false security which is often his destruction.

CHAPTER III. INGUINAL HERNIA.

Classification.—Inguinal hernia is the common variety, constituting two-thirds of the whole number observed. There are two forms, the oblique and the direct, or the external and internal, as they are sometimes called.

In the oblique the protruding viscus makes its exit at the internal ring, traverses the inguinal canal, following the spermatic cord, and passes out through the external ring, its neck (at the internal ring) being external to the deep epigastric artery, from which fact it receives its second name. (Fig. 628). In the female the descent is in the canal of Nuck, following the round ligament into the inguinal canal and at times as far as the labia.

The direct hernia makes its exit at the exter-

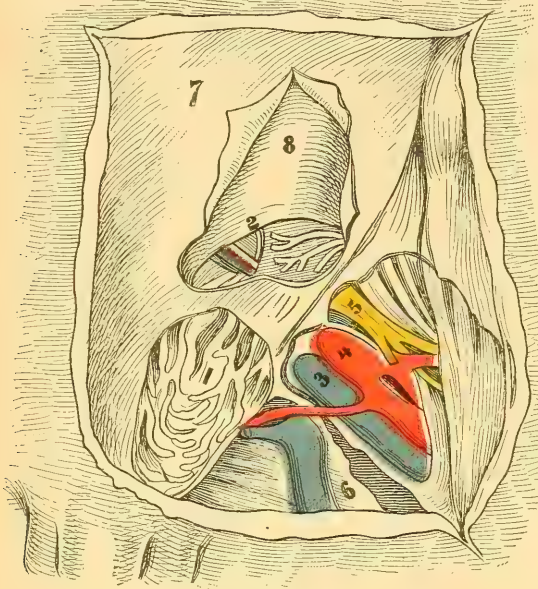


Fig. 628.

Relations of External Oblique Inguinal Hernia to Deep Epigastric Artery and Femoral Vessels. 1. Tumor Covered by Cremasteric Fascia. 2. Deep Epigastric Artery. 3. Femoral Vein. 4. Femoral Artery. 5. Crural Nerve. 6. Saphenous Vein. 7. Ex. Oblique Muscle. 8. In. Oblique Muscle.

nal ring without passing through the inguinal canal, pushing the fascia before the tumor, and its neck is internal to the deep epigastric artery. (See Fig. 632). If the protrusion remains within the canal it is called a bubonocoele, an incomplete or interstitial hernia; if it passes out of the external ring, a complete hernia; and if it occupies the scrotum, a scrotal hernia.

Oblique Inguinal Hernia.—Three forms of oblique hernia are recognized: (a) congenital, (b) infantile, and (c) acquired.

CONGENITAL FORM. This is the common form of infancy, although it may be developed in later life. It is called congenital, not because the hernia is present at birth, but because the condition which permits it is congenital:

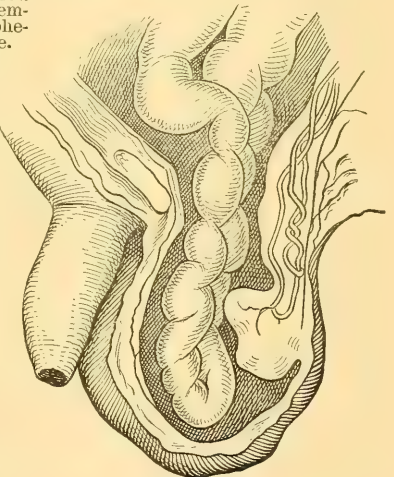


Fig. 629.

Congenital Oblique Inguinal Hernia.
(After MacLise.)

a lack of development resulting in an imperfect closure of the vaginal process of the peritoneum (see Causes). (Fig. 629). The hernia usually develops suddenly, passes down into the scrotum and lies in contact with the testicle, even passing below it, so that the gland is obscured, as in

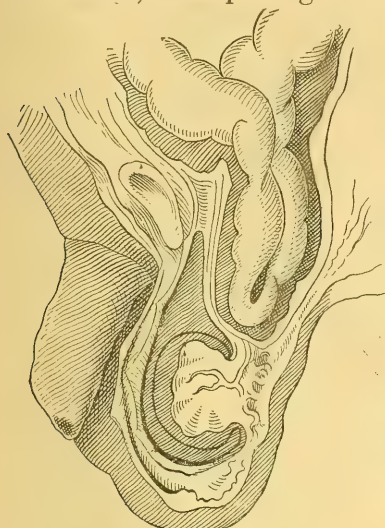


Fig. 630.

Infantile Hernia (Acquired), the Intestine Carrying with It a Process of Peritoneum by the Side of the Occluded Spermatic Tube. (After MacLise.)

hydrocele; or the testicle may be retained in the abdomen or canal and the hernia descend into the patulous canal. Another variety of this hernia has the funicular portion of the vaginal process for a sac, but is separated from the testicle by the closure of the testicular orifice. In both of these varieties the vaginal process proper forms the only hernial sac.

INFANTILE. Encysted hernia, as it is sometimes called, is another form which owes its peculiarity to an arrest of development. In this instance the vaginal process is closed at the ventral orifice, the external ring, but the testicular orifice of the funicular portion remains open, the tunica vaginalis testis thus extending up to the external ring. The hernia, with its own sac from the parietal peritoneum, protrudes into the upper part of the large tunica vaginalis, which is pushed before it into the scrotum. There, are

therefore, in this case three layers of serous membrane before the bowel in the scrotum; two layers of the tunica vaginalis and the true hernial sac, a fact which in an operation for strangulated hernia may be a source of much embarrassment.

ACQUIRED HERNIA. The third form, the acquired indirect inguinal hernia, is the common form. Passing through the internal ring, the inguinal canal, and the external ring, it presses before it the peritoneum, the infundibuliform fascia, the intercolumnar fascia, which with the superficial fascia and the skin form the coverings. The spermatic cord is usually behind the hernia and intact. Occasionally the component parts may be separated, one portion lying before and another behind; more rarely the cord may be spread out in front of the hernia. In the female the coverings and the relations of this hernia (congenital, into the canal of Nuck), and acquired inguino-labial, are the same as in the corresponding hernia of the male, if the round ligament be considered instead of the cord. (See Figs. 630 and 631.)



Fig. 631.

Complete Inguinal Hernia as It Occurs in the Adult. (After MacLise.)

Direct Inguinal Hernia.—This form escapes from the abdominal cavity by a direct route at the point where the outer margin of the rectus muscle is attached to the crest of the pubis, by descending and pressing before it the conjoined tendons of the internal oblique and the transversalis. It enters the inguinal canal just as it is about to terminate below and at once emerges from the external ring. In the few cases in which it divides the conjoined tendon its coverings do not differ from that of the indirect hernia, but when it presses before it the conjoined tendon these fibres, instead of the cremasteric, as in the indirect hernia, form its coverings. The spermatic cord or round ligament, in this form, is usually found along the outer or posterior side of the hernia, although it may pass on the anterior or under side. It is possible also that the hernia may not escape through

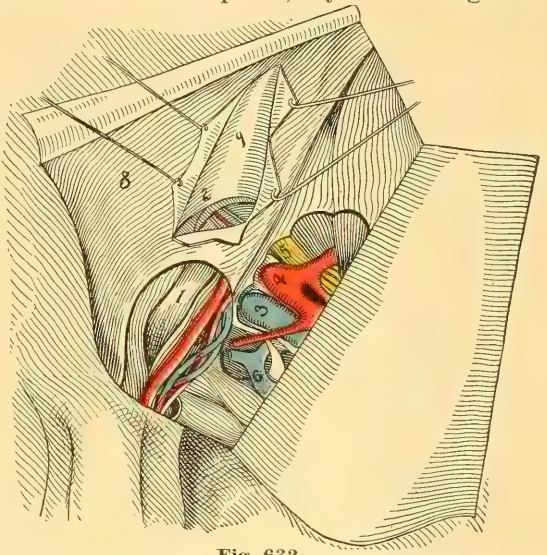


Fig. 632.

Relation of Internal Direct Hernia to Epigastric Artery. 1. Tumor. 2. Deep Epigastric Artery. 3. Femoral Vein. 4. Femoral Artery. 5. Crural Nerve. 6. Saphenous Vein. 7. Spermatic Artery and Vein. 8. Ex. Oblique. 9. In. Oblique.

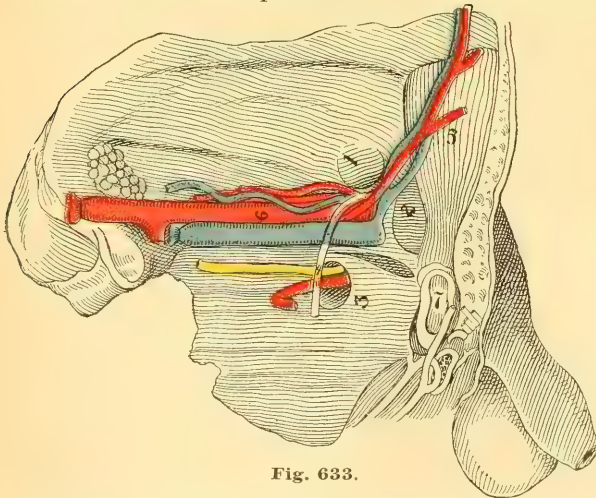


Fig. 633.

Relation of Points of Escape of Direct and Indirect Inguinal and Obturator Hernias to Important Vessels. 1. Internal Abdominal Ring, Point at Which Indirect Hernia Begins. 2. Approximate Location of External Abdominal Ring, Point at Which Direct Hernia Begins. 3. Obturator Opening. 4. Vas Deferens. 5. Epigastric Artery and Vein. 6. Iliac Vessels.

determine whether it is direct or indirect, congenital, infantile or acquired. In old oblique hernias the weight of the hernial protrusion may so displace the internal ring that the two rings become nearly opposite each other, the oblique direction of the canal being lost and the hernia being in fact direct, so far as its canal is concerned. If then the early history is not clear,

the hernia may not escape through the external abdominal ring but through the abdominal opening close to it, in which case the neck would not be in contact with the cord or round ligament. (Fig. 634.)

Diagnosis of Non-Strangulated Inguinal Hernia.—In most cases it is not difficult to determine that the patient has an inguinal hernia, remembering the common symptoms of hernia, and observing the location in the inguinal region; but it is much more difficult, often impossible, to

the diagnosis as to the exact variety is impossible. The following differential points are relied upon: The direct hernia is a rare form. It is situated near the median line. Its neck enters the abdomen behind the external ring. It is rounded or spherical in form and is usually of small size. The oblique hernia is the common form. It has a history of more gradual formation. It commences nearer the middle of Poupart's ligament, higher up and further out than the direct. It is of an oval shape if small, a pyriform if large, more readily becomes scrotal and often attains a large size. It is often equally difficult to make the diagnosis of congenital hernia, the decision resting more upon the history of the case than upon the tests furnished by examination. If the hernia was noticed soon after birth, if associated with an undescended or partially descended testicle, if no history of strain can be obtained, the probabilities are in favor of the congenital form.

DIFFERENTIATION. The following conditions sometimes very closely simulate inguinal hernia, viz.:—Undescended testicle, abscess, fatty tumor, hydrocele of the cord, varicocele, and enlarged lymphatic glands.

An undescended testicle can be distinguished by the absence of the gland in the scrotum, the impossibility of reduction, although this can sometimes be accomplished, and the peculiar sickening pain caused by pressure upon the gland. I saw recently in consultation in this city a gentleman who gave a history of non-descent of the testicles until the fifteenth year of age. One day while handling the left testicle he pushed it up into the inguinal ring, and it has never since descended.

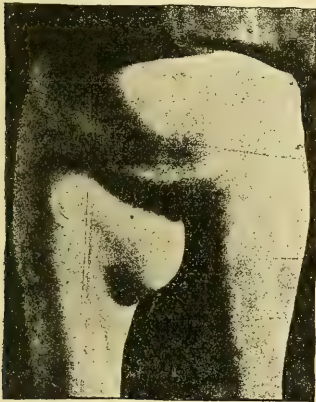


Fig. 634.
Hydatid Tumor Simulating
Femoral Hernia.—
Author's Case.

An abscess which has originated in the lumbar or pelvic regions may pass through some portion of the inguinal canal. It may be reducible and have an impulse upon coughing. It may be distinguished by its fluctuating character, by the absence of gurgling when reduced, by the protrusion at some other place when it is reduced, by the sense of resistance, and by its return, even in the recumbent position. The history

of pelvic or lumbar abscess is nearly always present, and is always a valuable guide.

A fatty tumor from the sub-peritoneal or connective tissue of the cord may simulate a hernia, especially an omental hernia, but the doughy feel, the permanency of the tumor without pain and the prompt return upon apparent reduction are usually sufficient evidence of its character.

An hydatid tumor (Fig. 634) may closely simulate an irreducible inguinal hernia. The history, the uniform growth, the painless character and often lobulated form are usually sufficiently marked to prevent error.

Simple hydrocele of the cord may be distinguished by its more tense, elastic feel and the impossibility of complete reduction. While reduction cannot be absolutely made, the little tumor may be pushed up between sub-integumental and muscular tissue, and reduction be simulated. Many cases have come under my notice in which families have been much

alarmed and the patient kept in pain and distress by the attempt to hold the tumor in place by a truss.

Diffuse hydrocele of the cord, especially in children, is a more difficult matter. It is prominent in the erect posture, and has an impulse on coughing. It has, however, the more tense feel of the hydrocele, is more pyriform in shape than the hernia, and by the aid of the candle can be shown to have greater transparency. It also returns more quickly on assuming the recumbent posture.

Varicocele may be mistaken for scrotal hernia, but the worm-like feel of the varicocele is usually distinctive. If the patient is placed in the recumbent position and the scrotum raised the varicocele disappears, as does the reducible hernia, but if now the finger is placed firmly on the abdominal ring and the patient allowed to stand the varicocele will gradually return, but the hernia will not until the pressure is removed. On the other hand, if the pressure be made upon the cord below the inguinal ring, before the patient rises, and he then stands the varicocele will not return, but the hernia will, especially if aided by coughing.

Hydrocele of the tunica vaginalis may simulate an irreducible scrotal hernia, but may be recognized by its greater translucency, its tense, elastic feel, its painlessness, its slow formation from below upward instead of from above downward, and from its being more readily separated from the cord.

Hydrocele and hernia may co-exist, and many of the distinctions above given be absent. This is especially true if by violence in attempts at reduction or otherwise the contents of the hydrocele have become changed into blood (hematocele), giving it a firm but less elastic feel.

Treatment of Reducible Inguinal Hernia.—METHOD OF TAXIS. The palliative treatment of reducible inguinal hernia consists in the reduction of the hernia and the application of a retentive truss. In the reduction of the tumor the method of taxis advised under the head of taxis in the treatment of strangulated hernia may be closely observed, remembering that in the oblique hernia the direction of force applied must be up and out, and in the direct, up and in. Having reduced the hernia the truss is at once applied. No person suffering from hernia which is reducible should assume the erect posture unless the truss is worn, or the parts are held temporarily by the hand or bandage. A properly fitting truss should retain the hernia in place on all occasions, not cause pain or disturbance, and yet be firm enough to attain this object and not have so powerful a spring that absorption of the abdominal parietes results and the hernial opening is enlarged. Every hernia requires a special adaptation to its special peculiarities. A truss successful in one hernia or on one patient may be a failure on another.

If the conditions cited above may be obtained and the truss worn constantly a good proportion of cases will be cured, especially in the young. It must not be forgotten in this connection that the commencement of a cure by truss pressure dates from the last time that the omentum or bowel came into the sac. The hernia must not come down under any circumstances, either in walking, standing, jumping, sitting or running. It may be difficult to prove but I am firmly convinced that the closing of the rings, especially in congenital and infantile hernia, may be materially aided by the careful use of the indicated constitutional remedy.

among which the remedies of Schüssler stand preëminent. If, as I believe, and as many authorities recognize (see Causes), hernia is largely due to arrested development, there is every reason to hope that remedies will have the same beneficial tendencies in awakening forces of the system in the muscular and tendinous structures as in the bony tissues.

Infantile and congenital hernia, as stated when referring to the general causes of hernia, are nearly always accompanied by phimosis. Irritation resulting from this condition, as well as the straining at micturition so often accompanying it, is an active agent in the maintenance of the rupture. In all these cases treatment of the rupture should be preceded by circumcision. I have treated many cases in which the hernia has never appeared after the operation and treatment for phimosis, although the parts were not supported by a truss. Indeed, in the large majority of cases, if all irritation is removed no mechanical treatment is demanded, hygienic and medicinal measures alone being sufficient to result in a cure before the end of the first year. The prevalent and vicious custom of applying a tight band around the child's abdomen should be condemned; for, although it may not cause hernia, yet by the increased pressure which it produces against the abdominal rings it interferes with its spontaneous cure. If the rupture is large or does not readily return to the abdominal cavity upon assuming the recumbent position a truss must be worn.

TRUSSES. The selection of a truss is often a matter of great difficulty. The contrivances which have been invented are innumerable, each having its earnest advocate and each claiming universal applicability. In some the spring is formed by a belt which encircles the pelvis, and in others it is situated in the pad itself. The pad is usually made of some hard material—wood, ivory, india rubber, or celluloid. In selecting a truss certain principles should be borne in mind, viz.:

First. The spring must offer certain resistance and yet adapt itself to the movements of the body. No contrivance so far invented fulfils the requirement as well as a narrow strip of well-padded steel covered with leather and fitted to the hip at a point about an inch below the crest of the ilium.

Second. The pad should be as nearly flat as its adaptation to the body will permit. Any attempt to retain the pad in position by making it so conical that it will press into the hernial opening must be avoided. This can only result in increasing the size of the opening, the truss itself acting as a wedge to dilate it.

Third. The pad should be adapted somewhat to the form of the opening and the direction of the canal, and should be as large as can be conveniently employed. It must not be so large, however, that it will press upon or interfere with the spermatic cord. A poorly selected, badly fitted truss is easily pressed down so that its lower border rests upon the crest of the ilium, causing pain and uneasiness in the cord and producing disease of the tunica vaginalis or the testicle.

An ovoid or elliptical pad of some hard substance usually fulfils these requirements most satisfactorily. The accompanying cuts show the forms commonly employed. (Figs. 635, 636, 637, 638, 639.)

Measuring for a Truss. Physicians away from a large city are often obliged to send for a truss. Under such circumstances the size of

aperture, the kind of hernia and the side upon which it exists should be noted, as well as the direction in which it is desired to make pressure, forward, backward, up or down, as well as the circumference of the pelvis a little below the crest of the ilium, the distance from the inguinal ring on one side to that of the other, and the distance of the hernial opening from the anterior-superior spine. It is rare that the spring of a ready-made truss accurately fits the patient. The back may be broader or the hip more prominent than the model upon which the truss was constructed. An accurate outline of the surface to which the truss is to be applied may be obtained by the use of lead tape. Lay one end over the internal ring of the affected side and then carry it directly around the body on a line about an inch below the crest of the ilium. Press the yielding lead close to the skin so that an exact outline of the form may be obtained. Make a tracing of this upon a piece of paper and send this with the directions. The spring may be modeled upon this tracing and afterwards tempered to the required pressure.

Application of a Truss.

The patient is placed upon his back and the hernia reduced. The spring is now carried about the pelvis and the pad applied directly over the internal ring.

When so placed it should rest entirely upon the soft abdominal walls, at no point touching the bony structure.

In direct hernia the pad is placed over the point of exit, which is usually the external ring, and its pressure should be in instead of up and in as in the indirect form.

The patient may then arise and go through the various movements of walking, and sitting on a low stool. The pad should remain in place without the attachment of the leather strap to the back of the pad, this latter attachment being brought into play only under violent motions to

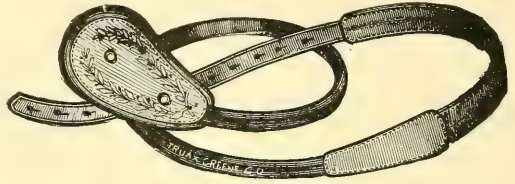


Fig. 635.

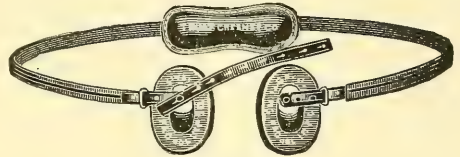


Fig. 636.

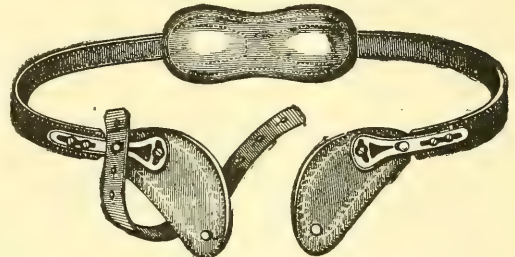


Fig. 637.

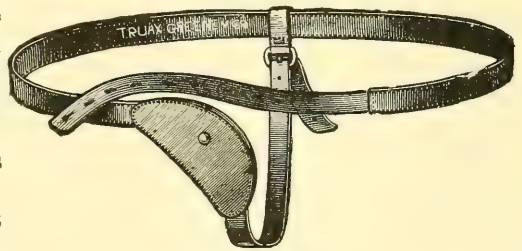


Fig. 638.

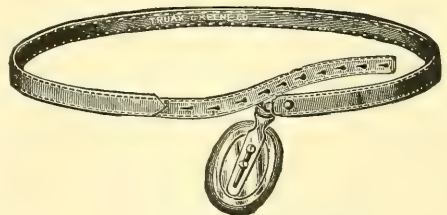


Fig. 639. Trusses.

prevent the displacement of the spring. As a final test the patient may be directed to stoop forward with knees apart and cough violently. If the pad retains the hernia under these conditions it may be accepted.

Wearing a Truss. The truss should be worn constantly during the day. It should be put on before arising and not be taken off until after going to bed. If the hernia comes down even upon assuming the recumbent posture a night truss should be worn. This may have a lighter spring than the day truss and may be prevented from slipping up by a perineal band. Patients with tender skin often become excoriated by the friction of the pad. This is more common when the pad is covered with cloth or some soft substance than when it is made of bone, ivory, or hard wood. The pad should be cleaned at night, the skin washed and bathed in alcohol and powdered. Under no circumstances should the truss be left off while erect, even if the hernia shows no tendency to come down. It not infrequently happens that after wearing the truss for awhile the hernia will not come down for some time after the removal of the truss. Any sudden exertion may bring it down, and it is a noticeable fact that it is in these cases that strangulation most frequently appears.

CHAPTER IV.

RADICAL CURE OF INGUINAL HERNIA.

Operative Considerations.—The propriety of operative measures for the radical cure of non-strangulated hernia has long occupied the attention of the surgeon, and the history of the various methods that have been adopted is of the greatest interest. The great fatality which followed early operations resulted in the almost total abandonment of the operation. With the advent of antiseptic surgery a renewed interest was awakened and such operations as those of Wood and Wutzer were extensively tried; but it was not until the introduction of aseptic surgery and the almost complete removal of risk to life in the operation that a rational method of treatment was attempted and a large measure of success has been obtained.

In advising this operation three questions may be considered, viz.: I. What cases demand the operation? II. What is the risk to life? III. What is the probability of cure?

CASES. There are certain cases in which the first question can be easily answered, viz.:

(a) All cases which cannot wear a truss on account of retained omentum. In many of these cases the adherent part may be so small, a mere fasciculus, that it cannot be determined by the finger but may be suspected by irritation produced by the truss.

(b) Irreducible hernia, in which the possibility of strangulation is always present, and in which the seriousness of the condition is all the more marked if the occupation of the patient is liable to take him some distance from capable medical aid.

(c) Cases of mal-position of the testicle which prevent the wearing of a truss.

(d) Cases which cannot be retained by a truss on account of the character of the opening, the form of the patient or the character of his occupation.

(e) Cases in which the presence of a hernia prevents the patient from entering into some public service.

Besides these cases which demand an operation there is a large class of people to whom the wearing of a truss is a great annoyance, who are made irritable or despondent by the thought of a deformity, or who live in constant fear of strangulation. This large class, while not absolutely demanding the operation, is made better by it and if the risk is not great is warranted in applying for such treatment. This brings up to the second question.

THE RISK. No statistics on this question are of value that cover a period prior to the advent of aseptic surgery, about 1880. Since then reports have been made by Svesson and Erdman of one hundred and six cases with one death; Champonniere, two hundred and seventy-five cases with two deaths; Macewen, eighty-nine cases, with one death; Bassini,

two hundred and sixty-two cases with one death; Halstead, eighty-two cases with no death; Kocher, one hundred and nineteen cases with no death. Indeed the last author declares that fatal results do not follow properly conducted operations unless due to attendant causes. He says if one should keep under observation hundreds of cases of all ages and classes and present them with a good dinner every day he would occasionally be able to announce a death among them. To this opinion I am inclined to subscribe; for I have had but one death in eighty-eight consecutive cases and in this case the patient had been bed-ridden for years because of the impossibility of wearing a truss, due to chronic localized peritonitis.

PROBABILITY OF CURE. The percentage of cures is a more difficult question to determine because of the impossibility of following the patients for any period of time. Bassini reports two hundred and fifty-one cases with only seven relapses, but a large proportion of these cases was under his observation for periods ranging from six months to one year only. Halstead claims equally good results. Other operators claim all the way from fifty per cent. to eighty per cent. of cures. The author's results fully bear out the favorable statistics quoted.

There are three requisites to the making of a successful operation for the radical cure.

First. The prevention of suppuration.

Second. The obliteration of the sac.

Third. The restoration of the inguinal canal.

This canal is, in its natural state, about one and one-half inches in length. Its internal opening is an inch and a half to the outer side of the external opening. Its direction in the abdominal wall is such that under normal conditions pressure from the abdominal contents tends to close it. In old cases of hernia the weight of the contents draws down the internal ring and this valvular arrangement is lost. If possible this condition must be restored.

Operation.—The first requisite is obtained by the careful preparation of the patient and the maintenance of aseptic precautions. "The aseptic suture must be aseptically applied in aseptic structures and the wound must be maintained aseptic." The bowels are thoroughly cleaned out by a cathartic the day preceding the operation, the patient restricted to a liquid diet and placed in bed. Twelve hours before the operation he is given a warm bath, and the abdominal, scrotal and pubic regions carefully shaved and scrubbed with soap and water. This is washed off with ether and the parts are bathed with bichloride of mercury 1 to 2000. Gauze saturated with the same solution is placed over the area, covered with gutta-percha tissue and retained by a bandage until the time of the operation. The dressing is then removed, the penis wrapped in a layer of bi-chlorided gauze and the field of operation surrounded by sterilized towels.

The hands, instruments and sponges to be used in the operation having been sterilized, an incision is made from a point over the internal ring to a point just below the external ring and over the line of the inguinal canal. All tissues are carefully divided until the sac is reached. If the sac is not congenital or is not too long it is dissected out entire, great care being used in separating it from the constituents of the cord.

This is one of the most difficult parts of the operation, and the separation will be facilitated by commencing it very near to the external ring, or even in the canal itself. At the lower portion of the sac it is always more or less adherent to the tunica vaginalis and injury to the tunic or testicle is easily produced. The greatest danger, however, is an injury to the vas deferens which is closely adherent to the sac. At an early stage in the operation this should be recognized and isolated. If any doubt exists as to the tissue being the sac it should be incised and the question decided by examination with the finger. If the finger enters readily and can be passed into the abdominal cavity the proof is positive. There need be no fear of opening the sac under aseptic precautions, indeed it should be opened in every instance and its interior examined.

In the female patient the separation of the round ligament from the hernial sac is often as difficult a matter as the separation of the spermatic duct in the male. The serous cover of this ligament is so intimately adherent to the sac that the removal of the sac without taking the ligament along is almost impossible. Fortunately no disadvantage arises from the resection of the round ligament, the stump promptly attaching itself to the abdominal wall. If the sac is a congenital one it may be opened very near to the ring, and having returned its contents to the abdominal cavity, or having assured one's self that it contains no bowel or omentum, it may be cut across about one inch from the external ring, and the scrotal end dropped into the scrotum and left without further consideration.

If the sac is a large one and its entire separation from the cord should prove a serious matter it may be treated in the same way as recommended for congenital hernia. In such cases, however, it is best to make a counter-puncture through the scrotum and drain the sac. In every instance the sac is opened and the interior is explored by means of the finger. If it contains adherent omentum this should be gently pulled down until the omentum is free, a ligature placed about the omentum and the excessive portion excised. There need be no fear of removing any amount of omentum, whether adherent or not. The author is in the habit, in cases of omental hernia, of removing all that extrudes, believing that by this means the probability of cure is very much improved. Although the vessels are large, sheep-gut of medium size is all that is needed. If the omentum is large and its pedicle bulky it may be secured by an interlocking chain-ligature instead of a ligature en masse. During this time the sac may be held with the forceps in order that it may not escape into the abdominal cavity.

Examination can now be made to determine the condition of the canal. If the hernial sac is long and narrow, if the finger, when thrust into the canal, passes up some distance before it reaches the mouth of the sac, if the internal ring is opposite the middle of Poupart's ligament and if the back of the inguinal canal is found intact, the operation may be proceeded with as follows: The sac is freed from the cord up to the internal ring. It is pulled down firmly, twisted several times upon itself, transfixed with a blunt needle as high up as the internal ring and tied with chromicized sheep-gut or silk. The redundancy of the stump is cut away and the stump is allowed to drop back into the abdomen; or it may be treated as recommended by Lockwood. After tying the stump in the manner described the ends of the ligature, which are left long, are used

to fix the stump beneath the fascia of the transversalis. A finger is used to make a bed for the stump of the sac in that position and the ends of the ligature are threaded into a Macewen needle, carried separately up the inguinal canal and pressed through the abdominal wall, except the skin. The ends of the ligature are then tied on the front aspect of the external oblique muscle, and the skin, which has been pulled up to permit this, is allowed to slip down and cover the ends of the ligature. The conjoined tendon is now approximated to Poupart's ligament by several deep sutures of strong silk. Finally the external ring is sutured as far as possible without pressing upon the cord and the incision in the skin united. If the hernia is a large one and has dragged the posterior wall of the canal down and in, so that the valvular character of it is lost, the operation must be modified.

In this class of cases, as well as in the cases of undescended testicle, after having laid bare the external ring and the external oblique muscle, the inguinal canal is slit up its entire length, the hernial sac is treated as heretofore described and the operation completed in the manner recommended by Bassini.

The spermatic cord is lifted out of the inguinal canal and held to one side. The border of the rectus and the edges of the internal oblique and the transversalis muscle and fascia are united to the deep surface of Poupart's ligament by stout silk sutures, thus restoring the posterior wall of the canal. Upon this new wall is placed the cord. The border of the external oblique is united to Poupart's ligament over the cord. The superficial fasciæ are then united in the usual way.

After-Treatment.—The after-treatment, so far as the wound is concerned, does not differ from that of any other aseptic operation.

For fear of rupture of the abdominal wall the patient should be kept in bed for four weeks with the first operation, and from four to six weeks with the latter. He should not be permitted to engage in active employment for eight weeks. A flat abdominal pad should be used for several months after the patient is allowed to be upon his feet.

DIET. For the first twelve hours after the operation the patient should have nothing but water and for the next twenty-four hours nothing but liquids, such as beef-tea, milk, and water. Food is then gradually increased until the fourth day when ordinary diet may be given.

Other Operative Proceedings.—The operation as here described may be varied in many ways. Instead of cutting off the sac Macewen preserves and utilizes it as a tampon. The sac is folded many times upon itself, transfixed with a ligature, returned into the abdominal cavity and fixed by a ligature at the internal ring. (Fig. 640). The conjoined tendon is then sutured to Poupart's ligament. (Fig. 641). Halstead, instead of trying to repair the old canal, makes a new one. The aponeurosis of the external oblique,



Fig. 640.



Fig. 641.

Fig. 640. Macewen's Operation; the Sac Transfixed and Drawn into Folds.

Fig. 641. The Sac as a Pad Covering the Abdominal Aspect of the Internal Ring in Macewen's Operation.

the internal oblique and the transversalis muscles and transversalis fascia

are cut through from the external abdominal ring to a point about two centimeters above and external to the internal abdominal ring. The vas deferens and veins of the cord are isolated and all but one or two of the veins of the cord are excised. The sac is treated in the usual way. The cord in its reduced form is raised on a hook out of the wound and deep sutures are passed through the aponeurosis of the external oblique, internal oblique and transversalis muscles and transversalis fascia on the one side, and through the transversalis fascia and Poupart's ligament-fibres and aponeurosis of the external oblique upon the other. The cord is brought out of the upper angle of the wound and placed upon the aponeurosis of the external oblique muscle, covered only by the skin which is sutured over it. (Figs. 642, 643.)

In these as well as the operation of Ball, Barker, Banks, Champonniere and others union by first intention is expected and desired. McBurney, however, advocates an open operation. The sac is dissected out and ligated in the usual way. The inguinal canal divided and the deep fascia sutured to the integument. The wound is then packed with iodoform gauze and allowed to heal by granulation. McBurney

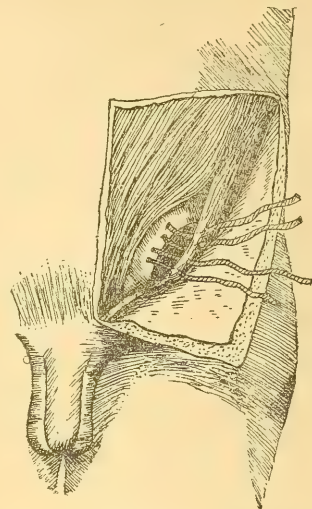


Fig. 642.
Macewen's Operation; the Threads
Ready for Tying.

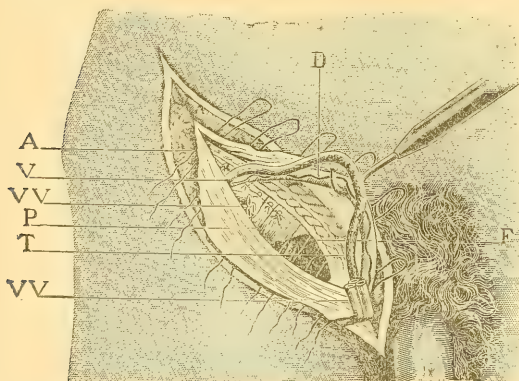


Fig. 643. Inguinal Canal Laid Open; Sac Cut Away After Suture of the Peritoneum; Elements of Cord Isolated and Lifted Up; Deep Mattress Sutures Introduced.

A.—Aponeurosis of the External Oblique Muscle.
D.—Vas Deferens. F.—Fascia Transversalis.
P.—Peritoneum. S.—Buried Skin-Stitch, Tied.
T.—Buried Skin-Stitch, Introduced, but Not Tied.
T.—Conjoined Tendon. V.—Vein.
VV.—Stumps of Excised Veins.—Halstead.

claims that this method prevents and dimpling or funneling of the peritoneum and that the resulting scar tissue serves as a sufficient barrier against relapse. I believe, however, with Bull, that the operation is based upon views of reparative processes not in accord with the sound tenets of pathological changes, that relapse must be inevitable and unmanageable. We know that scar tissue possesses neither the pliancy nor strength of muscular tissue, and that the tendency is always in the direction of absorption and condensation. At a recent

meeting of the American Surgical Association, May 28, 1895, McBurney said he devised the operation when the subject was very undeveloped. He did not feel at all satisfied with the results. In certain conditions the operation was advisable but not in many cases.

Treatment by Injection.—The success obtained in the treatment of hydrocele by injection led to the adoption of this plan by Velpeau, Pancost and others. It was extensively tried for a time but without much success. Some years afterward it was again introduced by Heaton, and has since been modified by Warren, Degarmo, and others. The results have not justified the sanguine expectations of its advocates and it has been almost totally abandoned. It is still practiced by hernial

specialists, and is occasionally successful. It is worthy a trial in those cases in which the consent to a more radical operation cannot be obtained. The Heatonian operation may be performed in the following manner:

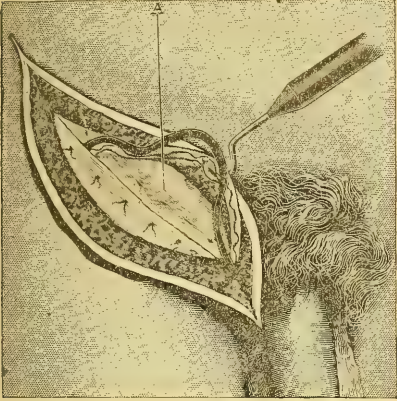


Fig. 644.

Deep Sutures Tied.—Halstead.

The operator introduces the index finger of the left hand through the external ring and up to the canal until the internal ring is reached. The finger is here held and with the right hand the needle of the syringe is entered over the finger and perpendicular to the plane of the abdomen at this point. As soon as the tip of the needle is felt by the index finger the finger is slightly withdrawn so that the invaginated scrotal integument may not be transfixed. With the needle in position a few minims of the fluid are expressed and the needle is slightly turned in all directions. The index finger is slowly withdrawn and the needle is made to follow it to the external ring, gradually expressing the fluid. About twenty minims may be employed. A slight compress is placed over the point of the puncture, and the patient kept quiet for a few days until the acute irritation has subsided.

A truss with a wide soft pad is then applied. Several injections may be necessary to complete the cure. Recent hernias and those in which the canal has not been too widely stretched offer the best prospect of success. The treatment is not wholly devoid of danger and may be followed by abscesses and severe scrotal inflammation. This latter accident is usually due to the injection of the fluid into the scrotal tissue outside of the external ring.

The solution used consists of

Extract of quercus alba gr. xiv.

Fluid extract of quercus alba, oz. ss.

Thoroughly mix over a hot-water bath. To each injection one drop of carbolic acid and $\frac{1}{2}$ gr. of morphine may be added.

CHAPTER V.

STRANGULATED INGUINAL HERNIA.

Symptoms.—The symptoms of strangulated inguinal hernia are enumerated under the topic, “General Symptoms of Strangulated Hernia.” Add to these the presence of an irreducible tumor at the inguinal ring, and the diagnosis is easily made.

An inflamed, undescended testicle may be mistaken for a strangulated hernia, especially if accompanied by nausea, but the absence of the testicle in its proper place in the scrotum should at once lead to a suspicion of the correct condition. Such a case came under the author's service at Hahnemann Hospital, Chicago, the patient having been sent from one of the eleemosynary institutions of the city.

Appendicitis may be, and has been mistaken for strangulated hernia. The vomiting, constipation, severe pain, and the presence of a tumor are all symptoms common to hernia. Careful examination will, however, show the tumor to be internal to the internal ring and above it. The tumor, moreover, has a broad base and the external ring is patulous. An inflamed inguinal gland may occupy the exact location of the external ring, and may present many symptoms of chronic strangulation; but in almost every case a careful study of the history, added to the fact that the finger can be insinuated into the external ring, should be sufficient to make a correct diagnosis.

Occasionally a patient, the subject of an old irreducible hernia, is seized with abdominal pain, nausea and vomiting. It may be difficult to decide whether these symptoms are due to the crowding down and strangulation of the intestinal contents, or to a sharp attack of indigestion. If this cannot be decided by a careful survey of the history of the case it should be considered a case of strangulated hernia and treated accordingly.

Treatment.—In making taxis for the reduction of strangulated inguinal hernia, the same rules should be observed as have been enumerated under the head of general treatment of strangulated hernia. It may be remembered that the direction of force in the indirect inguinal hernia should be up, in and out, and in the direct hernia up and in. Failing to reduce the hernia, recourse should at once be had to herniotomy.

HERNIOTOMY. This operation is often demanded at times and in places where all the accompaniments of a good hospital are not at hand, nevertheless no case is so urgent that strict cleanliness should not be enforced, the patient properly shaved and cleansed, the hands and instruments properly prepared.

The bladder should be emptied and if there has been much fecal vomiting the stomach may be washed out with a siphon irrigator. The patient should be warmly covered (only the seat of operation exposed) and if weak or collapsed the extremities should be surrounded by hot-water bottles.

He is then placed on his back with his thighs slightly abducted and rotated outward. The incision is made from a point above the internal ring to the lowest position of the sac, unless it be of very large size. The different fasciæ should be successively divided until the sac is reached. After the skin is incised further incision should be made carefully, inasmuch as there is great diversity among different persons in regard to the thickness of the hernial coverings. In emaciated patients the sac may appear to be almost directly under the integument, while in others the inflammatory effusions, or a large amount of adipose, may cause the sac to recede to great depth. It is desirable if possible to make long, clean incisions, to keep the wound free from blood, and to recognize the several fasciæ as they are exposed. It is not always possible, however, to do this. The sac is the anatomical point for which the operator is looking, and if he recognizes this the number of fasciæ he divides makes little difference to him.

As has been said by Banks, the great mistake in one's first operation is in thinking that the sac has been reached long before it has. In this way two or three extensive strippings are made and then after all another layer or two are found. By these strippings the cellular tissue is torn up, as a result of which troublesome sloughing and suppuration are apt to occur.

The identification of the sac is a matter of much difficulty, especially in the emaciated, in those who have worn a truss for some time, or in those cases in which great violence has been employed in efforts at reduction. In the fleshy subjects and in those cases where there is little inflammation, the sac stands out in distinct contrast with the mass of fatty and areolar tissue, being of a bluish color, slightly translucent and covered with vessels having a slightly aborecent form.

If in doubt the operator should proceed cautiously, picking up each successive layer of tissue with the forceps and nicking it in order to introduce the grooved director, upon which it is to be slit up.

When the sac is reached it is picked up in the same way and its lower anterior part nicked by a light touch of the knife, laid flatwise and then slit up on a grooved director. The sac should be entered near its base, for at that point it usually contains a little serum, which protects the intestines from the knife while higher up the contents may be adherent to the sac. The escape of the serum is one indication that the sac has been opened. The intestine will be recognized usually by its form, convoluted or folded upon itself, or by its color, which is usually of a dark red or purple. The omentum will usually be recognized by its fat cells and its long, dilated vessels. Where omentum and intestine are both present, the former is usually in front. If omentum only is found a careful examination should be made further up the sac to determine whether there is not a knuckle of intestine behind it. The following are the directions usually given for the relief of the stricture: The finger is passed into the sac and up to its neck, or, if this cannot be admitted, a grooved director is passed beyond the stricture, a probe-pointed hernia knife is introduced and the stricture divided. If the stricture is at the external ring the incision may be made up and outward, if at the internal ring, upward. Inasmuch as it is often difficult to ascertain whether the hernia is direct or indirect the safest rule is to cut

upward, as this offers the slightest possibility of severing the deep epigastric artery. In most instances this incision may be very short, the simple nicking of the stricture often being sufficient. The author believes that in most instances it is better to cut down upon the stricture rather than to follow the classical custom and crowd an instrument into it. The latter plan originated in the early time, when it was considered dangerous to incise the sac and when the stricture was divided outside the sac without opening and examining its contents. It is open to the objection that the operation thus conducted is a blind one and that it is quite possible to do great injury. The part of tissue that suffers most in strangulation is directly embraced by the stricture; it is liable to be swollen and softened and any attempt to introduce the finger or knife may tear or bruise it. It is possible also that the bowel may overlap the director and be cut by the movements of the knife; or some artery, the epigastric, may be nicked or cut and troublesome concealed abdominal hemorrhage result. Having severed the stricture, the loop of bowel should be gently drawn down and the constricted part examined, since it is here that the injurious effects of the strangulation are most pronounced.

If the bowel contained in the hernia be simply congested and there are no adhesions, it should be gently returned to the abdominal cavity. If it is adherent to the sac, and the adhesions are recent, they may be carefully separated from the sac by the finger. If they are old and consist only of a few tough bands these bands may be severed by the scissors. If the adhesions are firm and close a portion of the sac may be excised and left upon the intestine. If the intestine is of a dark-red or purple color it may be safely returned. If it is of an ashen color or of a brownish yellow, if it crepitates on handling, it should be covered with a warm, sterilized towel. All constrictions being relieved, it should be left for a short time in order to determine if, upon the release of the circulation, vitality will return. In determining the question of the viability of the constricted intestine Nothnagle's experiment may be tried. He applies a few crystals of common salt on the gut near the constriction. If peristalsis is set up in the intestine and extends over the constricted portion, it may be considered viable and may be returned to the abdominal cavity. If the gut be found to be gangrenous, one of two methods may

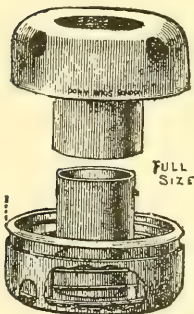


Fig. 645.

Anastomosis Button.

be employed. First, the entire gangrenous gut may be fastened outside of the abdomen and opened at once. By this method the patient may recover with an artificial anus or fecal fistula, which can be closed at a later period when the patient has regained his strength. (See Colotomy.) Second, the gangrenous gut may be resected, the cut sections of the bowel brought together for immediate union and the parts returned to the abdominal cavity.

In the making of this operation the Murphy button may be advantageously employed. The operation is made, according to Murphy, as follows:

End-to-End Approximation. The intestine is cleared of its contents, and the intestinal compression clamps are placed in position. The mesentery of the portion to be excised is ligated; the intestine is excised; a running thread

is placed in position by a top stitch along the excised edge; beginning opposite the mesentery and continuing down to the mesentery, one return over-stitch is taken at the mesentery (Fig. 646 *a*); and then the top stitch is

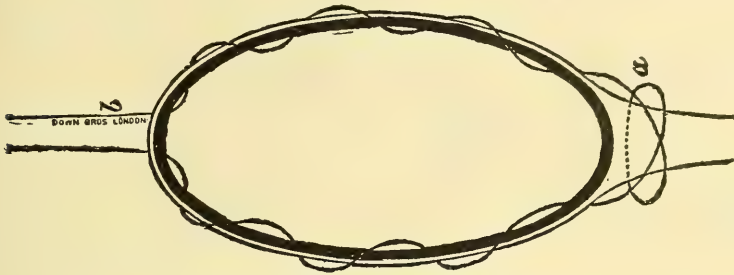


Fig. 646. End-to-End Approximation.

continued up the opposite side to the starting point; this constitutes the "puckering-string," and when tied around the stem of the button, which is then inserted, draws the cut edge within the clasp. Particular attention should be given to the return over-stitch at the mesentery, so that both layers of the peritoneum overlap. The other half of the button is inserted in the same manner, and the button is then pressed together.

I advise the use of a special size button, one and a half inch in diameter, for the end-to-end approximation of the large intestine. It is more easily applied and has a larger central opening for the temporary passage of feces.

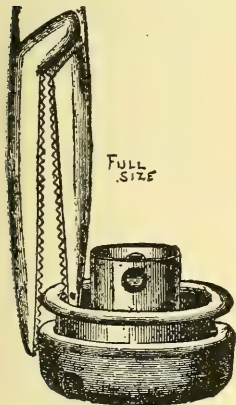


Fig. 647.
Showing Method of
Holding Elastic
Cup for Insertion.

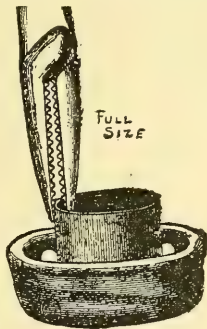


Fig. 648.
Method of Holding
Female Half of But-
ton for Insertion.

The first of these methods may be advised if the general condition of the patient is unfavorable, and if it is difficult to determine the exact amount of intestine involved. It is also the safer plan in one who is unskilled in operations upon the intestines. The second has the advantage of prompt recovery, does away with the inconvenience of a fecal fistula, is not attended with the disturbances of nutrition which are often present when the part of the intestine involved is high up in the intestinal canal, and does not

submit the patient to the danger of a second operation for the closure of the fistula. It is attended, however, with greater shock as well as the danger of infection from an imperfect suture or a gangrenous gut. That it is the ideal operation there can be no doubt, and it should be the adopted procedure unless good reasons exist to the contrary.

No absolute rule can be laid down to determine the operation to be selected. It must depend upon the judgment and tact of the operator to determine the proper procedure to be adopted. Indeed, many modifications of the two operations may be made. Thus, if the gangrenous patch is small or some doubt exists as to its capability to maintain its integrity

the procedure for the formation of an artificial anus may be varied by fixing the gangrenous area within the deep portions of the wound, packing the wound with gauze, and instead of opening the gut, relying on nature to make the anus preternaturalis if this must come. By this means

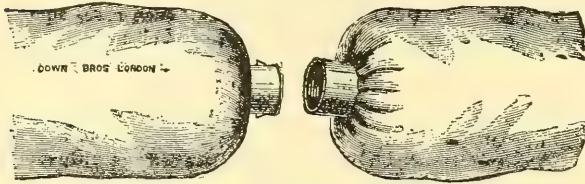


Fig. 649.

the gut remains patent and if an artificial anus results the opening is smaller and the closure by natural process more probable. If it does not result the doubtful intestine is not unnecessarily jeopardized. No

fear need be entertained of injury to the intestine. It may be retained in the wound for a number of days in gauze packing, and when its viability has been established returned to the abdomen. Again, if the gangrenous patch is small and is limited to the furrow made by the constricting band the gangrenous portion may be excised and the hole in the gut closed by lateral suture as in case of gun-shot wound. By this means the patient is saved the perils and annoyance of an artificial anus and the great shock of complete excision of the gut. Helferich has recently combined enterostomy with intestinal anastomosis. He makes an abdominal section and establishes an anastomosis between the intestine above and below the gangrenous part. Intestinal circulation being restored, the gangrenous gut which remains outside the hernial opening may be resected without danger, death from imperfect anastomosis prevented, and the prompt closure of the artificial anus facilitated.

If the hernia contains omentum, it should be drawn down until healthy omentum is reached, thoroughly unraveled and carefully examined to make sure that no portion of the gut is entangled in its fold. It should then be ligated in healthy tissue with sheep gut, either en masse or in sections, and the stump carefully returned into the abdominal cavity. This has been the author's invariable custom, and the results have been uniformly successful. Ashhurst advises that, after the incision of the omentum, retraction of the stump be prevented by securing the ligature to the external wound. Others have advised that it be simply cut away but not freed from the adhesions. This cannot be believed to be good practice, as it prevents the proper closure of the inguinal ring, and experience shows that this will not prevent subsequent hernias from protruding.

The bowel and the stump of the omentum having been returned into the abdominal cavity, the operation may now be finished in the manner described for the radical cure of hernia, viz.: ligation and excision of the sac and suture of the inguinal canal.

If the operation has been a clean one the external wound may be closed without drainage. If, however, there has been considerable inflammation of the external tissues, or if there is a possibility of the infection of the same by ulcerated omentum, a drainage tube should be inserted into the lowest depths of the wound.

COMPLICATIONS FOLLOWING HERNIOTOMY. If the parts have been bruised by prolonged manipulation, or thoroughly sodden by the applica-

tion of poultices, sloughing of the soft tissues may take place. Under these circumstances the wound should be opened, packed with iodoform gauze and allowed to heal by granulation. If peritonitis has set in before the operation was made, or if the peritoneum has become infected by the introduction of septic matter from without, or from a gangrenous bowel, the peritonitis may become diffused, and the operation give no relief.

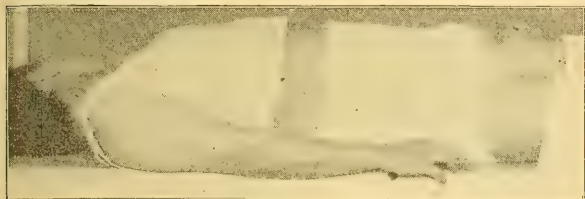


Fig. 650.
Operation for Hernia—Bandage Applied.

The symptoms present in such cases are pain, distension and tenderness of the bowel, and high temperature.

In this connection it may not be inadvisable to urge that the greatest care should be taken to prevent infec-

tion of the peritoneum when the sac, gut, or omentum is gangrenous or inflamed.

There is no doubt that the return of an inflamed gut or omentum has been the cause of many deaths following herniotomy.

In these cases immediate laparotomy should be performed and the parts thoroughly cleaned and drained. If the bowel be found to be gangrenous it should be kept outside of the abdomen, the object being to form an artificial anus. If symptoms of obstruction still persist after the operation the abdomen should be opened and the intestines carefully examined. Any constricting bands should be divided, adhesions to the omentum separated, or twists to the bowel relieved.

CHAPTER VI. FEMORAL OR CRURAL HERNIA.

General Considerations.—This form of rupture is more common in women than in men, and in the former occurs almost twice as frequently as the inguinal form. It is so called because the bowel, in making its exit, passes through what is known as the femoral or crural canal. This channel has a form something like an inverted cone. Its base, or the femoral ring, is formed by the interval between the femoral veins outside and the curved base of Gimbernat's ligament inside. Above is Poupart's ligament, and below is the pubis covered by the

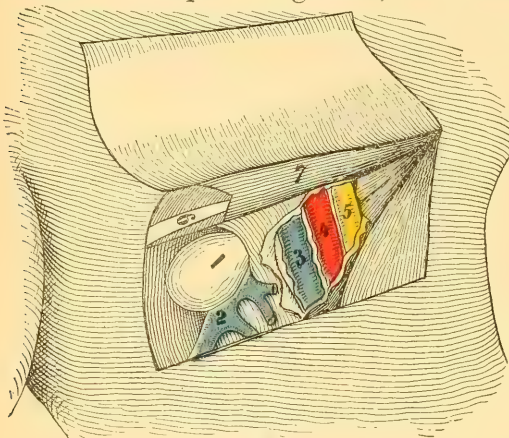


Fig. 651.

Relations of Femoral Hernia. 1. Hernial Tumor. 2. Saphenous Vein. 3, 4, 5. Femoral Vessels and Crural Veins. 6. Round Ligament. 7. External Oblique.

pectineus muscle. Its apex is at the saphenous opening, the point of juncture of the saphenous vein with the femoral vein. The sides of the canal are thus of unequal length. Superficially it measures, from Poupart's ligament to the upper border of the saphenous opening (Falciform or Hey's ligament), half to three-quarters of an inch; behind and externally from one and one-half to two inches. In as much as there is no organ to descend through this channel the peritoneal sac of the hernia is always acquired, never congenital. The hernia first makes progress by pushing before it the peritoneum with a dense layer of areolar tissue, which normally closes the femoral ring, known as the septum cruralæ. Passing through the ring it descends along the femoral canal, lying on the pectineus muscle, and covered by the sheath of the vessels, its direction being downward and a little forward. Having arrived at the saphenous opening it changes its course, turns forward, pushing before it the cribriform fascia, and then, curving upward over the falciform process of the fascia lata, lies upon the femoral vessels, and if large may even pass above Poupart's ligament, thus giving the appearance of an inguinal hernia. Its coverings from without in are the skin, superficial fascia, cribriform fascia, sheath of the vessels and the septum cruralæ and the sac. The neck of the hernia is at the femoral ring, and when strangulation occurs this is the point of stricture, the sharp edge of Gimbernat's ligament being usually the obstacle to reduction. This hernia is surrounded by important structures. At its outer side is the femoral vein, artery, and nerve, the first separated only by the septum of the crural sheath. On the same side

and slightly above it is the epigastric artery. On the inner side and above, separated by Poupart's ligament, is the spermatic cord, or the round ligament. The obturator artery, which in about one in three cases arises from the external iliac, common femoral or epigastric, instead of from the internal iliac artery, usually appears on the outer side of the crural ring, but in about ten per cent. of the cases ascends on the inner side, in which case it almost completely encircles the neck of the hernial sac. In this position it is in danger of being wounded in the operation for strangulated hernia. (Fig. 651.)

Diagnosis.—The diagnosis of femoral hernia sometimes offers many difficulties, especially in fat women or when the tumor lies on or above Poupart's ligament. It seldom attains a large size. It is firm, tense and rounded, lies on the inner side of the femoral vessels and invariably originates below Poupart's ligament. In determining this latter fact the pubic spine must be first found. This may be facilitated by abducting the thigh and thus bringing into prominence the abductor longus tendon, which arises immediately below the pubic spine. (Fig. 652.)

If the neck of the sac is outside of the pubic spine the hernia is femoral. It should be remembered that the line of Poupart's ligament is not represented by the crease in the groin, and in making a diagnosis this ligament should be carefully located and marked.

Enlarged lymphatic glands may be mistaken for crural hernia.

An interesting case of this kind was presented at the author's clinic in Hahnemann College, Chicago. The patient gave a history of a strain followed at once by great pain and a swelling in the groin. Nausea was present but no vomiting. A small tumor, hard, sensitive and irreducible, was found at the femoral opening. Upon incision it proved to be an inflamed gland which dipped down into the saphenous opening. Usually there is more than one tumor. There is no impulse on coughing and there is a history of slow growth, or at least the tumor does not make its appearance immediately on receipt of injury. The position is often different from that of femoral hernia. The latter has a tendency to turn over the falci-form process and occupy a higher position than the enlarged gland. It is possible however that a hernia and an enlarged gland may coexist. If the hernia be strangulated the diagnosis may be difficult. In such instances an exploratory incision should be made. A psoas abscess has an impulse on coughing and may disappear when the patient lies down, but there is no gurgling when it returns. It is always situated to the outside of the vessels and is usually accompanied by some spinal symptoms.

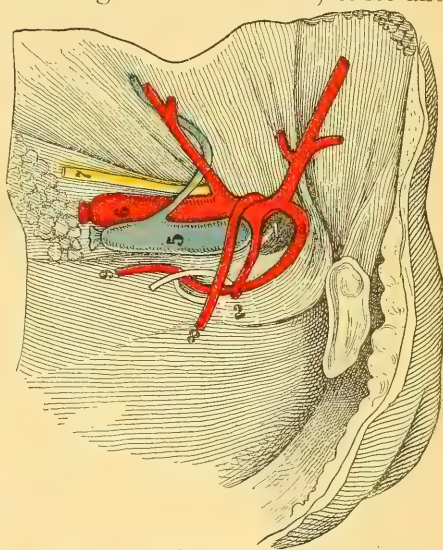


Fig. 652.

Relation of Femoral Ring to the Iliac Vessels and the Obturator Artery, when the Latter Is Derived from the Deep Epigastric. 1. Femoral Ring. 2. Obturator Opening. 3. Abnormal Origin of the Obturator Artery, when Derived from Deep Epigastric (3) and Passing External to Femoral Ring. 4. Normal Obturator Artery.

A dilated and varicose condition of the saphenous veins may simulate hernia, but there is no gurgling on reduction and the condition will return when the patient stands up, even though pressure be made at the crural ring.

A cystic formation in the crural ring may give rise to doubt and demand an exploratory incision. The tumor is more movable, however, than a real hernia.

Similar perplexity may arise from the presence of a lipoma in the crural canal, which may closely simulate omental hernia. It has no impulse on coughing, is dull on percussion and is irreducible.

In women another condition which may simulate femoral, or even inguinal hernia, and in which the possibility of error is always greater on account of its comparative rarity, is hydrocele of the round ligament, or hydrocele of the canal of Nuck. This condition, which has been considered of doubtful existence by many, is carefully considered by Coley, who has collected the report of ninety-two cases, to which I may add another not reported, and one by Ludlam.

It may be differentiated from femoral hernia by the fact that the tumor is distinctly located in the inguinal canal, or extends up into it, is not reducible, has no impulse on coughing, has no history of accident, or strain in formation, has increased gradually in size, and is unaccompanied by constitutional or severe local symptoms.

Reducible Femoral Hernia.—Reducible femoral hernia may be treated by the application of a properly fitting truss. The pad in most cases must be small and convex, and so made as to press just below Poupart's ligament and a little to the right of the pubic spine and the line of the crural canal. It is often a difficult matter to retain a truss in position, it being easily displaced by the movements of the thigh on the abdomen. For this reason the pelvic band must be reinforced by the perineal band to prevent the pad from slipping up on the abdomen. The same rules for the measuring, fitting, and application of a truss as given under the head of inguinal are here applicable.

RADICAL CURE. The same reasons which demand radical treatment in the case of an inguinal hernia are potent in the treatment of femoral hernia, and having determined upon this line of treatment, the same measures to prevent suppuration should be carried out. The sac is exposed by a vertical incision starting about one inch above Poupart's ligament, extending about two inches down the thigh. The incision should be kept as far away from the genital organs as possible in order to avoid infection. If there is any difficulty in finding the sac, which is often the case in fleshy persons, the spine of the pubis must be taken as a guide. The sac having been found, it is opened and its contents examined. If the intestine is found to be normal it is carefully returned. If omentum is found it is drawn down until it is free, ligated and excised.

Great care should be taken in the traction upon omentum that its vessels be not lacerated in the abdominal cavity. The operator should see that the stump of the omentum is not so large that it cannot be reduced. If there is any danger of this it should be ligated in sections and returned part by part. The sac is next freed from its surroundings, especially from the femoral canal, its neck transfixed and tied with a stout silk ligature. The part below the ligature is excised. The stump

is then thrust under the femoral arch, or, as suggested by Lockwood, the ends of the ligature may be left long, and each ligature threaded into a Macewen needle which is passed up the femoral canal along the sub-peritoneal tissue and thrust through the abdominal wall about the middle of Hesselbachs' triangle, just above the inguinal canal and its contents. As these sutures are passed the skin and subcutaneous fat are pulled out of the way of the needle, which emerges through the aponeurosis of the external oblique muscle, where it is unthreaded and the thread tied in a firm knot on the external surface of the aponeurosis. When the skin is released the knot is buried beneath it. The femoral ring is now closed by suture. A long-handled needle threaded with carbolized silk is passed through the posterior layer of the femoral sheath and the posterior portion of the fascia lata at a point about one inch below Poupart's ligament, the common femoral vein being protected by the finger. The needle is then thrust upward as far as the pectineal ridge, when it crosses the crural opening and passes through the lower part of Poupart's ligament. Similar stitches may be placed one-fourth inch apart until a sufficient number have been introduced to completely close the femoral ring.

The wound is closed in the usual way and the same directions as for the treatment of inguinal hernia are carried out.

Strangulated Femoral Hernia.—In making taxis for the reduction of this hernia the position of the hernia must first be noticed. If it has only partially escaped from the saphenous opening the direction of the force must be backward and upward. If, however, it has become reflected over the margin of the falciform ligament it should be lifted and drawn downward, then pressed backward and finally upward. If the seat of stricture is at the saphenous opening reduction is facilitated by flexing, adducting, and rotating the thigh inward. Whether this is also of service when the point of stricture is at the femoral ring is very doubtful.

Elevation of the body, and the application of cold and the other adjuvants recommended in the treatment of inguinal hernia may be employed.

Taxis is less likely to succeed in this form than in inguinal hernia, and the proportion of cases demanding operation is greater. Delay is also more dangerous because the symptoms are usually more acute and the constrictions more pronounced.

HERNIOTOMY FOR STRANGULATED FEMORAL HERNIA. When taxis fails an operation must be made. The same rules in regard to the preparation of the patient as given under herniotomy in the inguinal region must be carried out. An incision is made over the inner side of the tumor in the direction of its long axis—so placed that the upper border of the incision will correspond with the saphenous opening—and the tissues are carefully divided until the sac is reached. As a rule no vessels of any note are divided. The superficial or external pubic or epigastric will need ligature. In case there is no fluid in the sac great care must be exercised in the opening of it in order that the contents may not be injured. With the finger in the sac examination is made by pressing upward, the pulp facing inward, until the point of constriction is found. This is usually the edge of Gimbernat's ligament. Guided by the finger a hernia knife or blunt-pointed bistoury is gently insinuated between

the finger and the ligament, the edge turned inward and the constricting fibre divided. The bowel is now pulled down and examined, and if normal is returned. The omentum is ligated and removed. In reducing the bowel and omentum the thigh should be a little flexed, adducted and rotated in. The sac should now be dissected out and treated as directed under the head of "Radical Cure of Hernia."

One danger in this operation referred to under Anatomy of Femoral Hernia is the possible division of an abnormally placed obturator artery. This accident will rarely happen if the knife is not too sharp and the operator nicks rather than cuts the ligament. Should such an accident occur the wound must be enlarged and the bleeding part ligated. If the artery cannot be found on account of its retraction it may be successfully tied by placing a needle round about it, or by exposing the vessel by incision parallel to Poupart's ligament.

CHAPTER VII.

UMBILICAL HERNIA.

Classification.—Umbilical hernia appears under three forms: infantile hernia, congenital hernia, and the hernia of adults.

Infantile Hernia.—This is the common form of hernia in infants and makes its appearance some time after the separation of the umbilical cord. It is due to a stretching or yielding of the umbilical cicatrix. It rarely reaches a large size, and shows a decided tendency to a spontaneous cure. It may be treated by adhesive plaster. The integument is firmly pulled up on each side in order to form a pad over the umbilicus. This is held in place by a firm adhesive plaster. If the plaster irritates the skin, producing a troublesome eczema, as it often does, a truss formed of a flat piece of cork or a silver dollar may be applied and held in place by an elastic band. These hernias do not become strangulated, and as spontaneous cures occur in nearly every case operative interference of any kind is seldom needed.



Fig. 653. Umbilical Hernia.

Congenital Umbilical Hernia.—

This form is common in both sexes, but is believed to be more common in the female than in the male. In the development of the fetus, the last part of the peritoneal sac to close is at the navel, and an arrest of development at this point results in a congenital umbilical hernia. Sometimes the hernia is very large and may include spleen, liver, and even the stomach. Other times it is small, containing a small knuckle of intestine which protrudes into the cord. Careful examination should be made of a thick cord before ligation, as cases are recorded where in ligating the cord portions of intestine have been caught in the ligature.

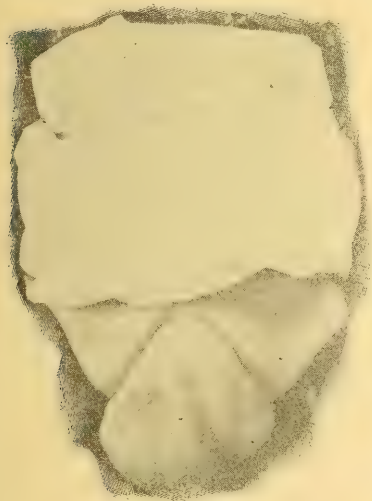


Fig. 654.

Umbilical Hernia.—Macdonald.

TREATMENT. If the hernia is small and is detected at birth, the contents should be returned and the cord tied close to the surface of the abdomen. By this means the peritoneal surfaces are brought together and the irritation of the ligature results in adhesive union; at the same time intestines are prevented from

extruding and the developmental tendency to close the navel opening is aided. If this plan is not adopted the treatment by adhesive plaster or truss as suggested under the head of "Infantile Hernia" should be carried out. Whatever the form of truss selected it should be made flat, and no plug should be allowed to enter the hernial opening; for while this may make it easier to secure the truss in place it tends by its dilating action to perpetuate the trouble rather than to aid in the closure of the aperture.

Umbilical Hernia in the Adult.—This form differs somewhat in origin and anatomy from that of the other forms just described.

The hernia may make its exit through the true navel aperture, but more frequently it is above, below, or to one side of it. The umbilical cicatrix, it is true, may be over the tumor, but careful examination will show that it is not over the center of the tumor. This hernia is found most commonly in stout women who have borne children, or in men with pendulous bellies. The ruptures are believed to originate in this wise. There are numerous small openings near the linea alba through which small branches of the intercostal arteries and nerves pass, though usually connective tissue or fat occludes these.

When a person becomes corpulent these openings become larger by stretching, and if subsequently the patient becomes thinner the absorption

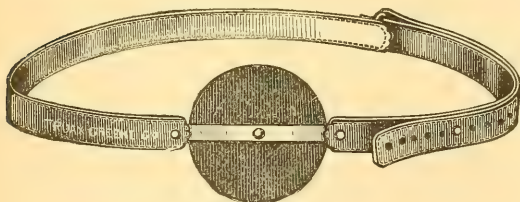


Fig. 656.

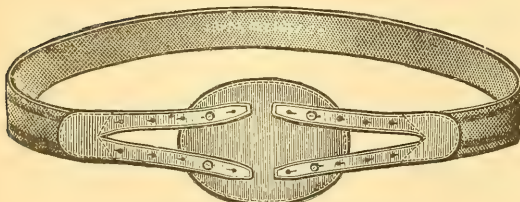
Fig. 657.
Umbilical Tusses.

Fig. 655. Pleural Hernia, Hernia Protruding Between the Ribs—Macdonald.

of fat leaves the openings patulous. Any violent effort may then result in a hernial protrusion. The contents of the hernia are usually omentum, which is often loaded with fat and thickened by inflammatory effusions. Sometimes the colon is found in the sac and cases are seen in which almost the whole abdominal contents are found outside of the abdominal cavity.

TREATMENT. When reducible the hernia should be kept in place by a suitable umbilical truss. This should consist of a plate of rubber,

celluloid, or some other hard substance, sufficiently large to cover the aperture and to extend an inch or two beyond its margin. In the lighter cases

these may be made with a spring and strap. In stout persons a regular abdominal bandage should be employed. It should be so made as to cover the whole protuberant abdomen, coming well down into the fold of the groin and shaped and fitted at the sides and back. The aperture proper should be covered by a flat pad, molded to fit the parts. If there is any difficulty in holding this abdominal bandage in place it may be provided with shoulder straps and a perineal band. If the hernia is irreducible a cup-shaped pad may be placed over it to protect it and hold it in place in the manner just described. In the author's case of umbilical hernia in which almost the entire contents of the abdomen were extruded, a regular shelf was fitted to the patient and the contents allowed to rest upon this, being protected in front by a steel corset.

Strangulated Umbilical Hernia.—Should symptoms of strangulation make their appearance the patient should be given an anesthetic and an attempt be made at reduction by taxis. In large hernias the fundus of the hernia should be lifted up in order to avoid pressing the lower edge against the constricting opening, and the tumor gently kneaded and compressed. Great pressure should not be used if the tumor be tender, or if other symptoms of inflammation be present. Changes which take place in the sac are often very rapid and injury much more frequently results from manipulation, than in other localities. The nearness to the sympathetic ganglia of the stomach and liver increases the risk. If the hernia cannot be reduced herniotomy must be made. It may be well to remember that the point of strangulation in an umbilical hernia in an adult will usually be found at the lower part of the neck of the sac, where the weight of the contents, together with the pressure and weight of the clothing and abdominal belt, has pressed downward on the sharp edge of the abdominal opening and produced inflammation and adhesions. It must also be remembered that the covering of the hernia consists chiefly of the integument, which is often much attenuated by stretching.

Again, the patient's muscular development is usually feeble, and if the hernia is large the digestive organs become permanently deranged. This in connection with the embarrassed breathing which is often present in people afflicted with umbilical hernia makes the operation a difficult one.

HERNIOTOMY. The abdomen should be prepared as for abdominal section. If the protrusion is not too large an elliptical incision is made round about it extending into the median line above and below. The first incision is made through the skin and then deepened by carefully cutting through the sub-cutaneous tissue. If possible the aponeurosis of the abdomen should be exposed on one side of the neck of the rupture. When once reached it is followed all around the neck of the tumor and the tumor separated from the tissues until entirely isolated, being attached only by its neck. Following this method there is less danger of opening into the contents of the sac at some point where they are adherent to the sac itself. Selecting some point where the sac is free from adhesions to its contents, it may now be opened. Adhesions are divided, the bowel is freed and if there is no obstruction at the hernial opening the tumor is reduced. If there is obstruction the hernial orifice is enlarged above and below by means of a probe-pointed bistoury. This division may be extra-peritoneal. The hernial contents are returned to

the abdomen, adherent omentum which has been extruded being ligated and removed. The sac is dissected away from the edge of the opening, drawn out and down a little, and either sutured with a continuous suture and amputated half an inch below, or ligated with stout silk and removed. The margins of the ring are freshened and closed by means of silk-worm gut or strong silk. The skin and sub-cutaneous tissues are then drawn together and the wound closed. The patient is treated as for abdominal section. The operation as given is not only for the relief of strangulation but for the radical cure. The latter operation is rarely performed when symptoms of strangulation are not present, because the patients are usually unsuitable for operation, the aperture either being too large, the abdominal muscles too much atrophied, or other conditions being present which make a permanent cure improbable. Should an operation be performed when symptoms of strangulation are not present it may not be necessary to open the sac, but the neck may be dissected out and tied in the usual manner.

In ventral hernias which are not umbilical, and which are formed in the scars following operations for ovarian tumors and appendicitis, or which follow injury or abscess of the abdominal walls, the wound may be re-opened, its edges strongly freshened and re-sutured. (Fig. 658.)

In either umbilical or ventral hernia the closure of the abdominal wall may be made more perfect by the plans suggested by Marcey. He recommends that the structures composing the ring be divided laterally upon the plane of the abdominal wall, about one-half an inch in all directions. This admits of the coaptation of the sundered parts in a way to greatly widen the line of union, instead of bringing together the narrow edges of the tendinous ring, and besides affording this great depth to united parts it brings together freshened surfaces in a high state of vitalization. It also admits of the joining the tissues in three distinct layers of strong sutures.

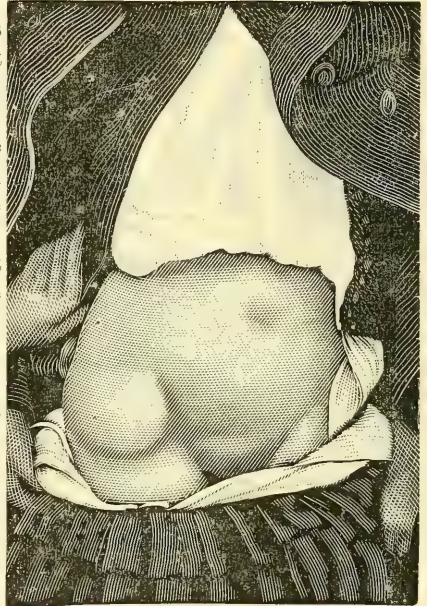


Fig. 658.
Ventral Hernia Following Appendicitis—Bull.

CHAPTER VIII.

RARER FORMS OF HERNIA.

Obturator Hernia.—In this form of hernia the protrusion passes through the foramen nearly at its upper part. It pushes before it the obturator fascia and probably a portion of the obturator muscle, and is covered by the pectineus muscle. It is internal to the femoral vessels and the neck of the sac, which is deeply seated in the obturator canal, may have the abductor artery at its outer or inner side.

DIAGNOSIS. When the protrusion is perceptible it may be differentiated from femoral hernia by its relations to the femoral artery and the body of the pubis. These structures lie behind the tumor in case of femoral hernia, but in front of it in the case of the obturator hernia.

When no swelling is observable, the symptoms of strangulation at the same time being present, the diagnosis depends upon the following symptoms: the history of colicky pains previously felt in the pelvic region, sometimes being relieved by a sensation of something having slipped back into the abdomen; sudden and violent pain felt at the upper and inner part of the thigh; cramps in the abdominal muscles; pain in the course of the distribution of the obturator nerve which may be reduced or increased by rotating the thigh outward, the pain being increased by making pressure on the external outlet of the obturator canal; and pain on pressing on the pelvic outlet of the canal with the finger introduced into the vagina or rectum. It is found most frequently in the female and rarely occurs before the fiftieth year. Notwithstanding the diagnostic symptoms given the condition is rarely recognized during life. Externally it occupies the place in Scarpa's triangle somewhat to the inner side of the femoral vessels and to the outer side of the adductor longus tendon. If the tumor be recognized taxis should be attempted with the thigh flexed, adducted and rotated outward. If this is not successful resort should be made to herniotomy. A longitudinal incision three inches in length should be made beginning a little above Poupart's ligament, passing down the inner side of the femoral vessels. The pectineus muscle must now be divided and the fibres of the obturator separated with the handle of the knife. The neck of the sac being recognized the stricture is relieved by nicking the thyroid membrane in a downward direction. (Ashhurst advised making the incision in an upward direction). Lateral incision should be avoided and the protrusion returned. If symptoms of obstruction or strangulation are present and indicate obturator hernia, although no tumor is perceptible, incision should be made in the linea alba, the hand introduced into the pelvis, and a careful examination made. If the lesion is discovered, effort at reduction may be made by traction from within, the thigh being placed in the position directed for the relaxation of the obturator muscles.

Lumbar Hernia.—This rare rupture is formed in Petit's triangle, the space bounded by the external oblique, the latissimus dorsi, and the

crest of the ilium. Before reaching the triangle the sac must pass through the lumbar fascia near the outer border and close to the quadratus lumborum muscle. Occasionally the hernia, instead of passing through the triangle, passes through an adjoining muscle. An interesting case of this character is reported by Shepherd. In this case, which was discovered during post-mortem, the opening was outside of the external oblique muscle, but not in Petit's triangle, the aperture being in the latissimus dorsi muscle and lumbar fascia. The canal opened into the abdominal cavity below the left kidney, a sacculated portion of the descending colon rested in the depression which existed there, and attached to it was a large inflamed appendix, which protruded through the opening in the fascia and muscle.

DIAGNOSIS. Its unusual location often leads to errors being made in the diagnosis. It has been incised under the belief that it was an abscess or a tumor. The diagnosis must depend upon the common symptoms of hernia. Fortunately it rarely attains a very large size, and is very infrequently strangulated. In twenty-five cases collected by McReady strangulation occurred in six of them. Three were successfully treated by taxis. The record of one case was lost, and two were operated upon; of these one recovered and one died.

Diaphragmatic Hernia.—This form of hernia is rarely recognized. It occurs both in the congenital and traumatic forms. In the former it is due to a defect in the development of the diaphragm. It occurs nearly always in the left side. The stomach, transverse colon, small intestines, spleen and the liver are the organs most frequently involved. All of these organs have been found in the thoracic cavity.

Symptoms are displacement of the heart and other thoracic viscera, as determined by auscultation, percussion, embarrassed respiration, and constipation.

Of the congenital cases collected by Bowditch, eleven died within two hours after birth, one-half died within one year and only eight lived until adult age. Should strangulation occur, and the condition be recognized, the thoracic cavity should be opened, the constriction relieved and an attempt made to close the aperture. An interesting case of this kind is reported by O'Dwyer.

The traumatic form results most frequently from stab wounds of the thorax and diaphragm. Of two hundred and fifty cases collected by Leichenstein only five were recognized before death. When recognized the external wound (thoracic) should be enlarged, resecting such portions of the ribs as may be necessary to obtain sufficient room, and the diaphragmatic wound closed with heavy sheep-gut or silk sutures. Several successful cases have been reported.

Perineal Hernia.—In this form the protrusion escapes between the fibres of the levator ani muscles. It is believed to be both congenital and acquired. In the male it appears near the anus or scrotum. In the female, in the labia or in the vagina. It is always reducible.

TREATMENT. A perineal band supported by a bandage is usually all that is required.

Ischiatic Hernia.—In this form there is a protrusion sometimes through the sacro-sciatic foramen, and sometimes below the pyriformis

muscle. Its neck lies between the sciatic nerve and the gluteal artery. It is covered by the gluteus maximus muscle.

Pudendal Hernia.—In this form the protrusion descends between the vagina and the ramus of the ischium, forming a small elastic tumor in the posterior part of one of the labia. It may be distinguished from an inguino-labial hernia by the fact that its long diameter is parallel to the axis of the vagina, by the fact that the inguinal canal is not invaded, and by its position along the ramus of the ischium instead of over the body of the pubis; from cystic growths and mucous cysts, by its reducibility and lack of tension. The rupture may be held in place by a suitable pessary, or by an elastic bandage.

In case of strangulation the stricture should be divided in an upward direction.

Vaginal Hernia.—In this form the protrusion may appear either in the anterior or posterior wall of the vagina, and may produce discomfort by pressing the rectum, or, by its retention of the urine, produce inflammation of the bladder. A properly fitted pessary will usually retain the part in position.

Pro-Peritoneal Hernia.—In this form of hernia the extruded

part lies within the abdominal or pelvic wall and, as its name implies, in front of the peritoneum (Fig. 659). It may be between the parietal peritoneum and the muscles, or between the abdominal muscles. It is usually complicated with undescended testicle. The hernia for a time may occupy the inguinal canal, and then on account of the obstacle offered by the undescended testicle be forced out, during a muscular effort, into the connective tissues between the peritoneum and the muscles. It is possible, also, that it may be due to the pressure of a badly fitting truss, or by ill-directed attempts at taxis, the pro-

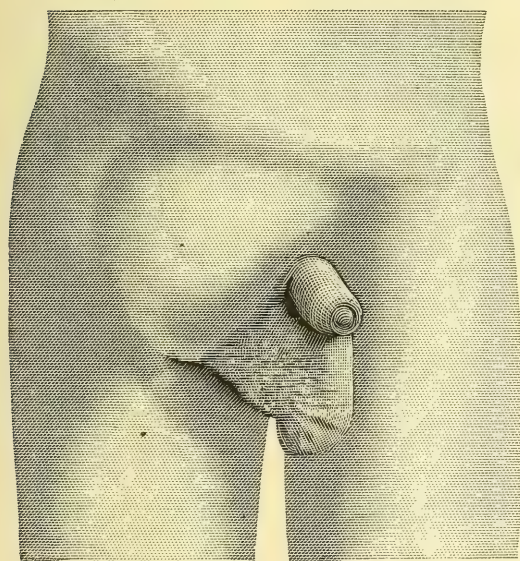


Fig. 659. Pro-Peritoneal Hernia.—Bull.

truded part being pushed in a direction different from that of the axis of the canal. These hernias are usually found above Poupart's ligament and parallel with it. If large, the tumor may hang over Poupart's ligament.

In making taxis for the reduction of this hernia more than usual care is necessary, the tumor apparently disappearing into the abdominal cavity when it has only been pushed into one of the spaces between the layers of the parietes. A truss then applied cannot help producing irritation and subsequent inflammation. The best treatment in all these cases is the operation for radical cure, with removal of the detained

testicle. Unless this is done the patient is in constant danger of strangulation of the intestine, and is usually in more or less pain from pressure upon the undescended testicle.



Fig. 660.
Mammoth Scrotal Hernia.

In case of strangulation, no attempt should be made at taxis but herniotomy be at once advised.

This form of hernia is comparatively rare, occurring about once in five hundred cases.

In an interesting case operated upon by the author at Hahnemann Hospital, Chicago, for radical cure, the hernia, as large as a fist, was found between the parietal peritoneum and the abdominal muscles. The undescended testicle occupied the inguinal canal, and while the spermatic duct reached only to the testicle the remainder of

the cord extended down into the scrotum and returned to the testicle. A rare case of mammoth scrotal hernia is illustrated in Fig. 660.

SECTION XXIII.

SURGERY OF THE KIDNEYS AND URETERS.

CHAPTER I. ANATOMY.

General Considerations.—Since 1869, when Simon, of Heidelberg, inaugurated a new era in renal surgery by the performance of a successful nephrectomy, nearly every renal affection excepting acute and chronic nephritis has been treated upon general surgical principles. And if the degree of success thus achieved has been somewhat variable it is not because the principles are unsound, but because one of the strongest factors in general operative success is early diagnosis, and the position of the kidneys, their duality, function, etc., are circumstances that sometimes combine to render diagnosis difficult.

Normal Surgical Relations.—The kidneys, encased in a thick layer of fat, lie on each side of the dorsal portion of the vertebral column, resting, posteriorly, upon the quadratus lumborum and psoas magnus. Their anterior surfaces lie in contact with and are covered by the peritoneum. The right kidney is about one-half to three-fourths of an inch lower than its fellow, is in relation with the right lobe of the liver, the duodenum and ascending colon. Its upper ex-

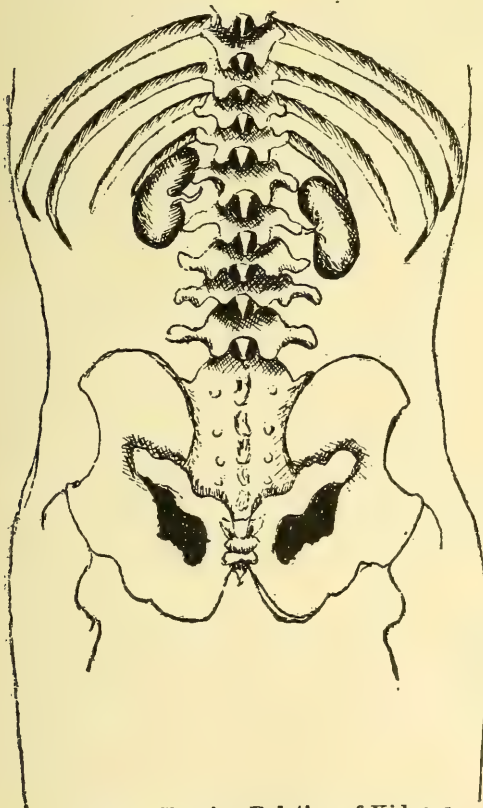


Fig. 661. Showing Relation of Kidneys to Bony Structures.

tremity corresponds to the lower border of the eleventh rib. On the left side the upper extremity of the kidney corresponds to about the tenth

intercostal space, its anterior surface is in relation with the cardiac end of the spleen and the descending colon. The lower extremities of the kidneys reach to within an inch and one-quarter to two inches above the crest of the ilium. A line drawn through the umbilicus is slightly below the inferior renal borders. (Fig. 661.)

Deviations from the Normal Anatomy.—According to post-mortem findings, about one subject in every four thousand has only one kidney. Associated with the solitary kidney may be found other congenital defects of the genito-urinary organs and appendages. The congenital single kidney is generally much larger than normal and quite likely to be misplaced, being found in the pelvis, iliac fossa, etc. It has been found lying upon the vertebræ at the bifurcation of the great vessels.

Occasionally the kidneys are connected, at their lower extremities, by true renal tissue or by a band of connective tissue. This is the so-called horse-shoe kidney. There are varying degrees of fusion, from a simple connecting band crossing the vertebral column to such an intimate blending that a shapeless and unrecognizable mass of renal structure results. As such organs are usually situated as low as the sacrum, they may and have been mistaken for functionless abdominal growths and removed, death resulting from complete anuria. Fortunately they are rare, occurring, perhaps, once in eight thousand autopsies. (Fig. 668, p. 1053.)

Other malformations, such as four kidneys in one subject, and four ureters in one kidney, have been found, but are too rare to require consideration here.

Another abnormality of greater importance to the surgeon is the fact that the twelfth rib is sometimes wanting and the pleura may be wounded in operations upon the kidney unless the operator remembers this fact and counts the ribs. In one series it occurred in five per cent. of the autopsies.

Examination.—Whenever surgical procedures upon the kidneys are contemplated it is of the highest importance to determine as definitely as possible their physical condition and functional activity. To ascertain the position and gross anatomical outlines of the kidney bimanual palpation may be resorted to. The patient may lie upon the back or rest on the hands and knees and then, by obtaining relaxation of the abdominal muscles, the palmar surfaces of the hands are pressed toward each other, one being pressed into the lumbar region between the last rib and the crest of the ilium, and the other opposite it upon the abdominal wall. The lower border of the kidney can be felt more frequently than its median or upper portion. (Fig. 662.)

This is by no means a perfectly satisfactory method of examination; for often the organ cannot be felt and it is undoubtedly true that, in the majority of instances, the easily palpable kidney is either hypertrophied or displaced. Of course, palpation is facilitated by anesthesia and its consequent muscular relaxation. Renal ballottement may be tried; deep, sudden and repeated pressure in the lumbar region will sometimes force the kidney against the palpating hand upon the abdomen. The functional activity of the kidney will be determined by a careful urinary analysis. If there be a one-sided kidney lesion, however, this will not be sufficient to indicate which of the kidneys is diseased. In grave surgical affections, such as pyelitis or renal hemorrhage, the cystoscope may render

valuable aid. Cystoscopy, unfortunately, is not always practicable; but when it is the ureteral openings may be viewed and the question as to which kidney is excreting pus or blood, which ureter may be occluded or absent, is readily ascertained. Such knowledge is invaluable, especially if nephrectomy be contemplated.

The ureter may be compressed by two fingers in the rectum or by a catheter-shaped metal instrument passed into the bladder. The bladder is then washed and the urine allowed to flow from the uncompressed ureter. The urine from the suspected kidney is thus separated and examined. Davy's lever has

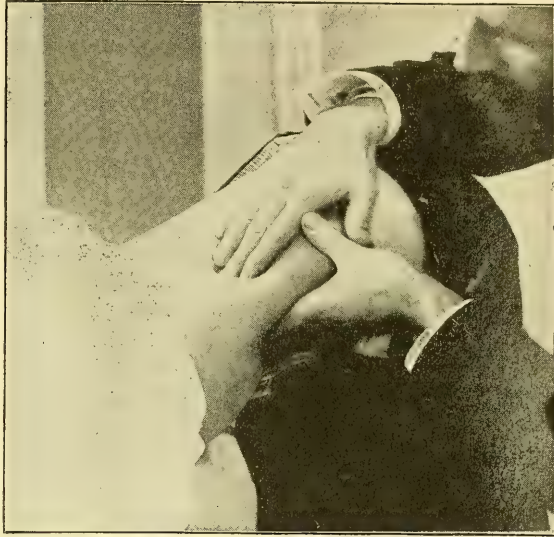


Fig. 662. Palpating the Kidney.

been used in the rectum to take the place of the fingers, but has never become popular. Catheterism of the ureters in women is also practiced as a method of obtaining the same knowledge. It may be done through a perineal section in the male or through the urethra in the female. Through the former the writer has found that in a bad case of unilateral pyelitis the introduction of a long silver sound into the ureter will demonstrate which kidney is affected. If the bladder is thoroughly washed and a sound introduced into the ureter leading to the suppurating kidney the instrument will be stained yellow by the action of the decomposing pus, which liberates sulphurated hydrogen. Sometimes the suspected kidney and ureter may be massaged—stroked downward—after the bladder has been emptied, and the character of the next specimen of urine may differ materially from the previous one. In desperate cases aspiration or even exploratory vesical or abdominal section may be necessary.

Movable Kidney.—Normally, the kidney is held in place by its tunica adiposa, by the peritoneum and blood vessels. There is a difference of opinion among writers as to whether the normal kidney is firmly anchored or whether it possesses, with its fatty capsule, limited motion. In rare cases the peritoneum surrounds the kidney and is attached to the hilum by a meso-nephron. Varying degrees of mobility exist, but their classification into floating, movable and palpable kidney has no pre-operative surgical importance. In general terms it can be asserted that the movable kidney is usually acquired. It occurs much oftener in women than in men. In 667 reported cases only 83 were males. It is generally found upon the right side, rarely upon both. In an analysis of 727 cases

it was found on the right side in 553, on the left in 81, on both sides in 93. It is probable that the pressure of the liver and the greater length of the renal artery render the right kidney more prone to displacement. Relaxed abdominal walls, especially after repeated pregnancies, emaciation and absorption of the perinephric fat, renal neoplasms, violent muscular effort, tight lacing, falls, jars, or other varieties of traumatism, have their causative influence. Occasionally the kidney becomes anchored in an abnormal position; it may likewise be found extruded and lying, with other portions of the abdominal viscera, in a hernial sac.

SYMPTOMS. Some degrees of renal mobility are symptomless. The most frequent symptoms are dragging, weight, discomfort or pain in the right lumbar region. Dyspepsia, melancholy, constipation and violent recurring attacks simulating renal colic may be present. These attacks may be augmented by torsion or kinking of the vessels and ureter, and consequent hydronephrosis. Pain may be complained of along the course of the anterior crural nerve, along the course of the ureter and in the testicle or labia. Usually the urinary function is not interfered with.

DIAGNOSIS. The patient is often the first to discover a "lump" in the abdomen which sometimes slips away from the grasp. This is most likely to occur if the patient is lying upon the back. Bimanual palpation will generally enable the examiner to discover the distinctive reniform outlines, the marked mobility and the readiness of reposition that are characteristic. It is in rare instances only that ovarian, omental or splenic growths, or distended gall-bladder need lead to confusion.

TREATMENT. If the recurring attacks of severe colic seem to be due to oxaluria or an excess of uric acid relief may be obtained by such attention to diet as urinary disturbance of this character demands. When the paroxysms of pain are due to kinking or torsion of the pedicle prompt relief is sometimes found in change of position or manipulation. Some patients suffer so little inconvenience that no treatment is required. If only moderately troublesome relief can sometimes be obtained by the application of a broad elastic band, padded in such a way as to make pressure to the right of the umbilicus. When this fails and the patient suffers considerably, or is incapacitated for business or work, or the general health status is lowered, nephrorrhaphy must be resorted to.

NEPHRORRHAPHY. This consists of fixation, by suture, of the kidney to the edges of the wound through which it is reached or to firm tissues of the abdominal wall. In properly selected cases, and properly performed, this operation may be expected to yield permanent relief and anchorage for the kidney. Its mortality rate among competent operators is about two per cent. The operation is performed as follows:

The patient is turned well over toward the abdomen with the under side and abdomen bolstered with pillows. This will produce convexity of the upper side and consequently separate, to the fullest extent, the crest of the ilium from the lowest rib. This is essential in order to obtain as much working room as possible.

A vertical incision from the last rib to the crest of the ilium is then made along the outer edge of the erector spinæ muscle. The incision is carried down through the latissimus dorsi, the external oblique, the internal oblique, the transversalis muscle and the lumbar fascia, which are crowded aside till the adipose capsule of the kidney is reached.

As the downward extension of the pleura is somewhat variable care should be exercised to avoid wounding it. It sometimes extends below the twelfth rib and the latter, as before stated, is sometimes absent, hence the advisability of counting the ribs.

Instead of the vertical incision, some employ the oblique, which is made about an inch below and parallel to the lowest rib. (Fig. 663). The kidney may be brought into the wound by means of pressure applied through the abdominal wall; the peri-renal fat is freely opened and then the fibrous capsule is incised vertically for about three inches. On each side of this capsular incision the capsule is peeled back, thus exposing a raw renal surface to be sutured to the freshly cut muscular surface. Two or more silk-worm sutures are then made to penetrate the parenchyma (through the reflected capsule) to a depth of one-half an inch or less, and for a distance of a full inch, emerging from the capsule beyond the other margin of the raw surface. These sutures are made to pass through the muscles on each side of the incision where they may be tied. Or, they may be left untied till some of the muscular structures are coapted in the bottom of the wound and over these the renal sutures may be knotted. They should

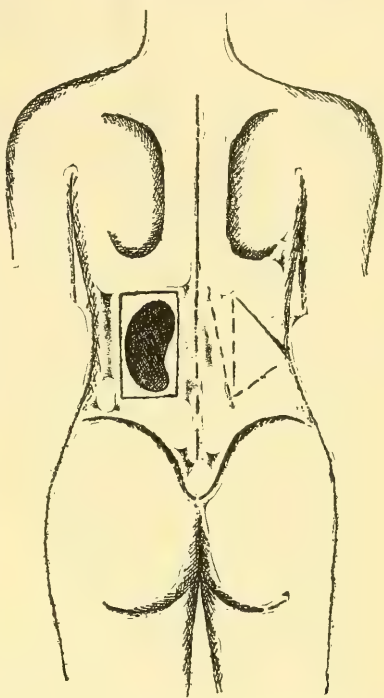


Fig. 663. Kidney—Normal Position.
Lines of Incision.

not be tied too tightly as they may cut through the renal tissue. If the operator feels sure of his asepsis he need make no provision for drainage but may close the wound, uniting the surfaces with buried sutures. If the technique is suspicious a drainage tube, a strip of sterilized gauze or a few strands of silk-worm suture may be introduced previous to suturing and left to conduct the discharges to the cutaneous surfaces.

There are various modifications of the procedure, but the principle is the same. Some pass the sutures through the fatty capsule of the kidney or through the fibrous capsule without incising it and exposing a raw surface. Others have sutured the kidney to the periosteum of the twelfth rib, which has sometimes been resected in order to permit of higher fixation of the kidney. As to sutures—probably silk and silk-worm sutures are the best, though chromicized sheep-gut, silver wire and kangaroo tendon have been used. It need scarcely be urged that the most rigid antisepsis be employed in the preparation for, and during the various steps of the operation. Lumbar hernia has occasionally resulted, the kidney extruding through the wound or its cicatrix. This is a rare occurrence.

The after-treatment consists of recumbency, preferably upon the back, for about three weeks. It is better not to allow the patient to

stand or sit for five or six weeks and even then to go about carefully and avoid severe muscular effort for three or four months. If the movable kidney be diseased or if nephrorrhaphy fails nephrectomy may be resorted to after ascertaining that a second kidney exists.

CHAPTER II.

NEPHRO-LITHIASIS.

Definition.—Nephro-lithiasis, renal calculus, kidney stone, gravel, are terms used to designate the solid concretions found in the renal pelvis or calices. They occur more frequently at the extremes of life, but may be found at any age. There seems to be a kinship between the gouty diathesis and renal calculi, and, consequently, they are found oftener in men than in women, and especially in men of sedentary habits who suffer from lavish feeding and lack of exercise.

Causes.—In brief, renal calculi are caused by an abnormal condition of the urine which results in the deposition of the urine salts. These precipitates consist of uric acid in the great majority of instances, nineteen out of twenty. (Thompson.) The oxalate of lime is next in frequency in the formation of the nucleus. Nuclei are of various kinds, consisting, at times, of bits of mucus, blood-clots, shreds of epithelium, tumors and parasites. A case is reported in which a vertebral sequestrum worked its way into the kidney and formed the nucleus for a stone. Cystine and xanthine are rarely found in the composition of calculi. The calculus may be uniform in its composition or it may consist of different chemical substances in alternating layers. The nucleus of uric acid or oxalate of lime is often covered with phosphatic layers. According to Taylor, the urate of ammonia is the nucleus of the calculi of infancy, uric acid forms the nuclei in early adult life, and oxalate of lime after patients reach the age of forty. Calculi vary greatly in size, number and shape. The renal parenchyma may be destroyed and its former site occupied by one large stone; or, the remains of the kidney may be a mere shell filled with dozens of small stones, gravel, sand and crystals. Most frequently there is but one, although if dependent upon constitutional (rather than local) causes they may be multiple and found in both kidneys.

Uric-acid calculi are generally smooth, brownish-yellow and hard; the oxalate of lime forms the dark, hard mulberry calculus with its irritating points and spines; the earthy phosphates form the gray friable stone. A large calculus may fill the renal pelvis or send prolonga-

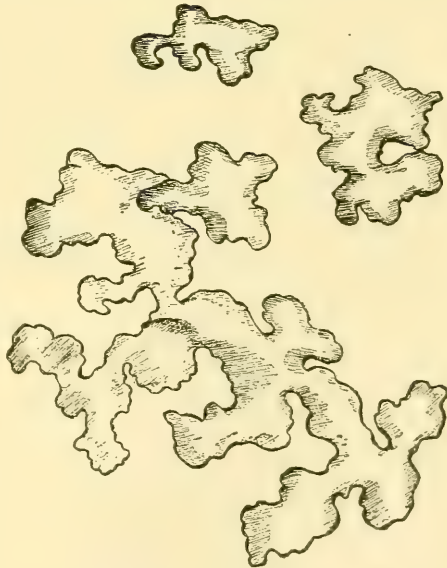


Fig. 664. Coral Calculi.

tions into various calices or even downward into the ureter. Such calculi resemble a branch of coral. (Fig. 664.)

Influence Upon the Renal Structures.—The structural changes induced by renal calculi are necessarily variable. If they exist as renal sand, or gravel, within the pelvis they may find their way into the ureter, thence to the bladder, where they remain to form a nucleus for a vesical calculus unless they are carried out through the urethra by the act of urination. They may also lodge within and obstruct the ureter. It is probable that such calculi cause less histological damage to the kidney proper than does its prolonged elimination of hyper-acid urine and its associated excess of urinary solids, which are the constituents of the calculi. The calculus may originate in any portion of the kidney and one or more may remain within the pelvis or parenchyma for years without giving rise to any symptoms. This is the exception however, unless the stone is encapsuled or is of the smooth oval variety. The rule is that, although imbedded in a calyx, the growth of the calculus necessitates pressure-absorption of the tissue surrounding it, or inflammation and subsequent induration due to the increase of connective tissue and decrease of renal parenchyma. As the stone increases in size it may ulcerate its way into the pelvis of the kidney, or even through the renal cortex and capsule, giving rise to subsequent perinephritis and occasionally to urinary fistula. The multiplicity of the calculi is readily comprehended, for the products of the inflamed or ulcerated mucous membrane or parenchyma provide local encouragement or nuclei for new calculus formations, while the diathetic tendency which was responsible for first stone still exists.

Calculi in the pelvis may so obstruct the ureter that the urine is retained within the kidney (hydronephrosis), or may cause inflammation of the pelvis (pyelitis), or of both pelvis and kidney (pyelonephritis), or suppuration of the same (pyonephrosis.)

Symptoms.—Naturally the symptoms are modified by the number, size, situation and character of the calculi. Patients may pass gravel for years without pain, or one or more may be passed, after which attack there is no recurrence. Recurring attacks of renal colic are the rule. The attack is initiated as soon as a calculus of any considerable size enters the ureter. Its onset is abrupt and apparently causeless, though it may succeed violent muscular efforts, as lifting. It is generally located in one loin, although it is believed that the pain may be accompanied by sympathetic nephralgia in the opposite loin. The pain is extremely severe, shooting down the course of the ureters and being complained of in the bladder, glans penis and testicle. The latter is drawn up toward the abdomen, on the side corresponding to the kidney containing the calculus. At times the pain is transmitted down the inner and anterior surface of the thigh. These attacks rarely last more than a few hours or a day, and end as suddenly as they begin. The sufferer often marks the change in the situation of the intense pain, such corresponding to the descent of the calculus through the ureter into the bladder. Its entrance to the latter is accompanied by cessation of the sharp, sticking, colicky pain, although lumbar and abdominal soreness may be complained of for days after. Such is the usual analysis of the acute pain, but it is believed that intense paroxysmal nephralgia may be produced by spasmodic contractions of the

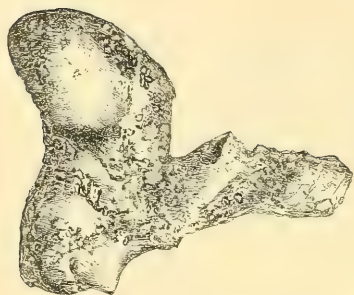


Figure 1.
Renal Calculus: Exact Size. Weight, 124 grs.
Chislett.

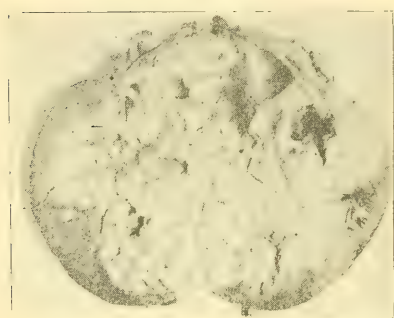


Figure 3.
Tuberculous Kidney.
Chislett.



Figure 4.
Multiple Abscess of Kidney.



Figure 2.
Peri-Renal Abscess.—Macdonald.

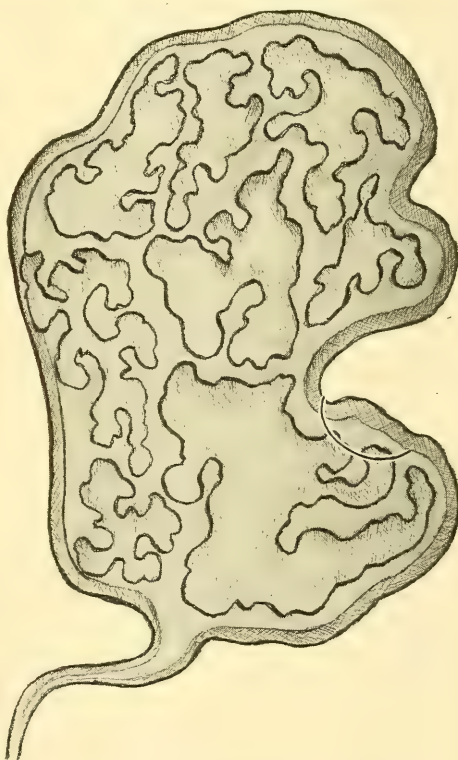


Figure 5.
Coral Kidney. Kidney Reduced to Shell; Spaces
Filled with Calculous Masses.—Macdonald.

ureter and pelvis even when no calculus is present. Instead of the sharp paroxysmal pain just described, or preceding it, there is a dull, intermittent or continuous ache deep in the lumbar region. This is usually aggravated by pressure or exertion.

GASTRIC OR SKIN SYMPTOMS. Renal colic is habitually accompanied by nausea and vomiting. This is probably reflex. The skin is cold and clammy, the pulse small and quick. There may be a rise in temperature or the attack may be preceded or accompanied by a chill.

URINARY SYMPTOMS. In most cases the urine will be highly colored, scanty and hyper-acid. Uric acid crystals may be seen in the bottom of the urinal as dark-brownish particles. The microscope will probably reveal pelvic and ureteral epithelium, uric-acid crystals, red blood corpuscles, and oxalate of lime crystals. Considerable mucus and pus may also be found, and if from the kidney they indicate pyelitis secondary to the nephro-lithiasis. An attack of renal colic is often preceded, accompanied or succeeded by hematuria, and even without such an attack intermittent hematuria is regarded as strongly indicative of stone in the kidney, and particularly if it appears after a horseback or rough wagon ride. It may be only slight in quantity, just sufficient to give the urine a dark, smoky hue, or long stringy clots appear and are thought to have obtained their form in their passage through the ureter. The bleeding is seldom profuse.

Frequent micturition is quite a constant symptom and is often so prominent that both patient and physician direct their attention to the bladder alone. This symptom may be continuous for months.

Within a few days after an acute attack of renal colic the patient frequently passes the calculus (one or more) during the act of urination. If very small it may pass unnoticed, but when larger it can be heard to strike against the urinal. Sometimes its passage through the urethra causes extreme pain and can be effected only after repeated and violent straining, or, it may lodge in the urethra and necessitate extraction. In one case the writer found it necessary to resort to a meato-urethrotomy for the removal of a good-sized roughened and craggy calculus, and lying loosely behind this were a half-dozen smaller ones.

Occasionally the urine is completely suppressed, due to simultaneous ureteral obstruction or to a reflex influence upon the vaso-motor nerves when only one kidney contains a calculus. Of course unilateral occlusion will cause complete suppression if, congenitally or by acquirement, the patient is the possessor of but one kidney. Complete obstructive suppression is rare, but when occurring is followed by symptoms of uremia and, unless relieved, by death in a few days. Diminution is more frequent than suppression. The latter may be quite gradual in its onset. In some instances a large amount of clear urine is voided.

Diagnosis.—First in importance is the history which, if it embraces recurring attacks of nephralgia or kidney colic and the emission of gravel, justifies a tentative diagnosis of nephro-lithiasis, particularly if the patient presents the group of symptoms just described. The diagnosis is fortified if the patient is of the gouty or uric-acid diathesis and is over-fed and under-exercised, as such patients usually are. Lumbar and abdominal palpation will elicit tenderness. It is occasionally possible to produce crepitus, by deep palpation, when there are numerous calculi. If con-

siderable hydronephrosis exists the kidney will bulge forward and may be palpated through the abdominal wall. Lumbar neuralgia, uterine and hepatic colic, ovaralgia, and local peritonitis should be excluded. Percussion along the flank and twelfth rib does not produce pain in neuralgia, but does in lithiasis. (Le Dentu.)

The urine is nearly always over-acid, the exception being in certain cases of phosphatic calculi; it should be analyzed frequently and carefully. In advanced nephro-lithiasis the urine, though still acid, will be cloudy with mucus and pus, the latter being deposited in the bottom of the vessel. A similar condition from stone in the bladder is not infrequently associated with offensive ammoniacal urine, alkaline in reaction. The bladder should always be examined to exclude the possibility of vesical changes or calculi being the origin of the symptoms.

General Treatment.—The prophylaxis of renal calculi belongs to the department of general medicine, but is of such importance withal that brief space may be allotted it here. It consists, in the main, in the treatment of the uric acid diathesis. This demands the exercise of some judgment, since there are instances in which it is no more a matter of over-feeding than it is of under-capacity to assimilate and metabolize what is ingested. The quality and quantity of the patient's food must be regulated. In general, the cereals and vegetables may be allowed, also fruit, those containing much sugar or oxalic acid being expunged. Cooked fruits are best. Highly seasoned and fatty foods, pork and any of its products, are objectionable. The interdiction of sugar and butter is a part of a Carlsbad "course." Chicken, game, mutton, beef, eggs (without the yolk), milk (without its cream) and fish (except the oily varieties) are allowable. It is important that spirituous and fermented liquors be interdicted. The hydro-carbons are believed to be more objectionable than nitrogenous foods.

The skin must be kept in a healthy condition by daily baths or by dry-brush friction and a moderate amount of exercise, preferably in the open air. The liver and bowels must be encouraged to act freely. Water should be administered in abundance. Better than ordinary drinking water is some slightly alkaline or lithia water. Carlsbad, Vals, Vichy, Poland, Bethesda, etc., are used freely. Potash (citrate or bicarbonate) in solution, ten to twenty grains three times a day, is often exhibited with at least temporary disappearance of the uric acid, but must be regarded as merely a chemical aid, not a curative agent. The artificial solutions are by no means as effective and valuable as are the natural solutions. In any case where the urine is thus changed in reaction it should be tested carefully; for a long-continued over-alkalinity of the urine will cause the addition of layers of phosphates upon the already existing uric acid calculi. The question of re-dissolving a calculus has long been a mooted one, especially among the laity and quacks. Time forbids its discussion here, but one fact is patent, i.e., that since the days when Pliny recommended the ashes of burned snail shells for this purpose no surgeon who has felt and heard the click of his searcher against a stone has reported a cure by the solvent treatment and verified it by post-mortem. And if renal or vesical calculi were amenable to this treatment surely some such instances should have been recorded during this period of nearly 2,000 years. The advocates of the solvent treatment admit

that it is not applicable to large calculi, and though the stone may grow larger during the alkaline treatment it is generally admitted that renal sand or uric acid crystals are soluble in an alkali. Further than this no evidence has been adduced to show the solubility of a calculus. On the contrary there are recorded cases claimed to be thus cured and the post-mortem has revealed the calculi. Many others have testified to the efficacy of such treatment in their own cases without ever knowing whether they had calculi or not.

As palliative measures for the attacks of renal colic hot compresses or a general hot bath may afford relief. If the patient does not vomit, hot soda water may be given freely. Inversion, local manipulation, change of position, and the passing into the bladder of a good-sized urethral steel sound occasionally cut short the attack. The internal administration of belladonna, berberis, china, nux, veratrum, etc., may be tried. If the paroxysm is violent anodynes are necessary. An ordinary dose of morphia ($\frac{1}{8}$ – $\frac{1}{4}$) may be ineffective and chloroform must be employed. The most useful remedies between the attacks are uva ursi, benzoic acid, china, calcarea, and lycopodium.

Surgical Treatment.—The surgical treatment of renal calculi is demanded when the occurrence of urinary suppression is dependent upon a stone in the kidney. Or, if without suppression all other measures fail and the renal condition causes constant distress and seriously impairs the patient's health and usefulness, operative interference should be resorted to.

NEPHROTOMY. The patient is prepared as for nephrorrhaphy, the lumbar incision deepened and the kidney exposed by freeing it from its fatty capsule. The kidney is palpated thoroughly in the search for calculi. The touch may detect it or it may be seen to bulge through the cortex. If not thus discovered, a needle may be thrust repeatedly into the parenchyma or pelvic wall till the kidney has been thus thoroughly explored. This should be done systematically, as more than one skilled operator has failed to find a stone that a later autopsy revealed. The stone being found, the kidney is incised (nephrotomy) and the stone is removed, (nephrolithotomy). The incision may be made through the parenchyma and into the pelvis, as it is thought that such an incision heals more kindly than if made through the pelvic wall, and consequently there is less danger of urinary fistula. The finger can be introduced within the incision and a careful exploration made. A small non-adherent calculus can be readily picked out by the fingers or forceps, but if very large it may require to be crushed before removal. Lithotrites, bone forceps, scoops and lithotomy forceps of various shapes and sizes may be found useful. Attempt should always be made to explore the ureteral orifice, which may be occluded. If a calculus is found at its mouth it will be removed, and a probe passed down the ureter. A calculus lodged in this position may be extracted with a pair of slender forceps, washed out by means of a stream of irrigating fluid, or pushed gently downward. The renal incision is next to be closed with sheep-gut sutures, a drainage tube surrounded with gauze is carried down to the kidney, the muscular wound is partially closed and a generous outside dressing applied. If there has been but little damage to the renal structures by the calculus or operative manipulations and the surgeon is confident that septic influences

have been excluded the wound may be closed, with buried and superficial sutures, without drainage. In many cases where no stone has been found the renal symptoms have subsided after the above procedures. This may be due to the fact that a slight pre-existing mobility of the kidney has been corrected by its inflammatory attachment to the wound, or that the stretching and division of the retro-renal nerves has relieved a neuralgia, or that renal capsulotomy has caused the subsidence of nephralgia due to spasmodic contractions of the pelvis and ureter or both.

If, in the operation for renal calculi, pyelitis, pyelonephritis, pyonephrosis, or tuberculosis is discovered, the contemplated procedures will be modified to accord with the treatment advised for these disorders.

CHAPTER III.

PYELITIS, PYELONEPHRITIS AND PYONEPHROSIS.

General Considerations.—Inflammation of the renal pelvis, unless in its simplest form, such as accompanies an attack of gout or uric acid storm, is so seldom disassociated from other kidney lesions that it does not require separate consideration. It is essentially a disorder of male adult life which affords the most numerous instances of inflammatory and obstructive changes along the urinary tract.

Causes.—Excluding the infectious diseases the etiology is much the same as that from which the greatest number of inflammatory vesical lesions arise. Irritation from renal calculi and ascending vesical infection are the most prominent. Traumatism, prostatic hypertrophy, strictures and obstructions (ureteral and urethral), the action of irritating drugs, tuberculosis, foreign bodies, neoplasms, and undue exposure are some of the rarer causes.

Pathology.—This necessarily differs widely, depending upon the cause and degree to which the affection has progressed. In the simple variety, catarrhal pyelitis, the mucous membrane is thickened, swollen and more or less raw and red, having lost much of its epithelium. Blood may be extravasated in minute quantities, and, with lymph and mucus, appear in the urine. Minute points of suppuration, ulceration and sloughing are found in the acute suppurative variety. The mucosa is more thickened and irregular than in the simple form, and around the pelvic wall is seen the round-cell infiltration. In what has been called calculous pyelonephritis or chronic purulent pyelitis the simpler form just described has engrafted upon it suppuration and its associated destructive changes. The renal parenchyma is destroyed and hardened interstitial connective tissue takes its place. The kidney may be much increased in size and filled with irregular pouches containing calculi, decomposed pus, shreds of broken-down cortex and epithelial debris.

Such a kidney, with its irregular sacculations, cannot drain properly and hence may become distended, all semblance to the natural renal outline is lost, and only a large, foul pus cavity remains. This condition is known as pyonephrosis. In some cases a pre-existing interstitial nephritis may have been the cause of induration and atrophy. Minute subcapsular and cortical abscesses, and long, slender white streaks in the pyramids are noted on section. It is but natural, in the infinite variability of things, that the different pathological processes are often mixed. To varying degrees of such destructive renal changes, especially when secondary to bladder affections, the term surgical kidney has been applied.

Symptoms. Whether one or both kidneys are involved will depend much upon the cause. If, for instance, pyelitis be due to sepsis from cystitis and foul urine it may affect both kidneys; if due to some local renal irritation it is more likely to be unilateral. The simple or acute pyelitis and pyelonephritis are somewhat rare. The onset may be abrupt and is

accompanied with a chill or chills, fever, anorexia, nausea, headache, tenderness and aching in the lumbar region. The urine, which may be diminished, is voided frequently, and may contain mucus, blood, and the spindle-shaped caudate or fimbriated epithelial cells, characteristic of the renal pelvis. If of local causation which persists, chronic calculous pyelonephritis or suppurative pyelonephritis is gradually established, and the urine, previously turbid with mucus, becomes heavier and thickened with pus which falls to the bottom of the glass while the supernatant stratum of urine becomes clear. The urine is acid.

All purulent urine is albuminous, but the excess of albumin may seem to be out of proportion to the amount of pus. Red blood corpuscles and tubular epithelium may also be found. A mobile calculus in the pelvis is frequently the cause of hematuria, the quantity of which is varied by the activity or quiescence of the patient. The passage of blood and fibrinous plugs or calculi through the ureter may give rise to no inconsiderable pain. Any of these may cause ureteral obstruction, and pyonephrosis in all its typical completeness is established.

In ascending infective pyelonephritis, secondary to vesical lesions the above symptoms are augmented and coupled with those of the bladder. In fact the latter may completely overshadow the kidney lesion, which is often discovered only by autopsy; for some of the former characteristics are lost by reason of the existence of the decomposed ammoniacal and alkaline urine. Of course, it frequently happens that the same septic and ammoniacal ferments travel upward through the ureter and the urine undergoes the same changes in the dilated renal pelvis; but in other instances the urine is acid till it reaches the bladder.

The general symptoms are as varied as are the degrees of renal involvement. Slight renal inflammation or even moderate suppuration may, at times, be unattended by any ominous constitutional symptoms, but when the lesion merges into its graver forms, or when both kidneys are involved, the effect upon the general physical economy is obvious. The urine is generally diminished and micturition may be almost ceaseless. Nephralgia is marked, and radiating pains in the branches of the lumbar plexus and pain in the groin, testicle and thigh are suggestive of calculus. Fever in the evening, occasional chill or chilliness, emaciation, dryness of the skin, nausea and vomiting, thirst, headache, dry, furred or thickly coated tongue, quick and small pulse are the usual symptoms. Later, hectic, high temperature, rigors, night-sweats, and perhaps diarrhea may supervene. These are but the usual symptoms of an ill-drained pus cavity and are frequently the precursors of amyloid degeneration.

Prognosis.—This will, of course, depend upon whether the cause is transient or removable, or whether treatment can be instituted early enough to preserve the integrity of the kidney. If the lesion is due to a calculus or obstruction it will probably be progressively destructive and may reach a stage when even the removal of the cause may not check the progress of secondary changes. Suppurating kidneys are often ill-drained, discharge intermittently, and may even rupture into the lung, intestine or loin, with resulting fistula. Suppuration may occasionally cease after evacuation by any of the above methods. Cessation will scarcely be expected however, in a calculous kidney on account of the causative persistence, and such methods of evacuation are fraught with

far more danger to life than is the more direct and surgical evacuation, removal of the cause or even the offending organ. If only one kidney is affected it may, in rare instances, shrink and its pus become inspissated or calcareous, the other kidney becoming hypertrophied and complete compensatory urinary function being established.

Diagnosis.—Simple pyelitis may offer some difficulties in arriving at a positive diagnosis. The symptoms and occasional associated fever, frequent micturition, with mucus, albumin and perhaps blood, pus and pelvic epithelia have already been spoken of. These may not all be present in the urine at the same time and are quite as characteristic of cystitis; but the latter may be excluded by washing thoroughly and emptying the bladder and analyzing the urine that is passed in the next few minutes. Another distinguishing feature of the renal lesion is the tenderness and occasional palpability of the kidney. Of course all the above symptoms may, by vesical and urethral instrumentation or operation, be superadded to a cystitis, which instance is a frequent pathological sequence and can scarcely be ignored. The advanced cases are more easily diagnosed, especially if the patient is gouty, tubercular, or has entered catheter-life on account of stricture or enlarged prostate. The previous history is therefore of the utmost importance. These latter stages of renal disorders are more likely to be attended by a palpable kidney, due partially to the distension and in part to the accompanying emaciation, which render palpation more satisfactory. Retro-peritoneal aspiration is resorted to at times as a diagnostic measure, especially when the kidney is much enlarged. For further aid in diagnosis see Examination.

Treatment.—The prophylaxis of renal calculi, which is probably the most frequent cause of pyelitis, etc., has already been considered. The infective or ascending form, which is frequently septic and secondary to inflammatory and obstructive changes, should be prevented by the most exacting attention to antisepsis in examination and in operating to relieve all infra-renal obstructions. If the disease of the kidney is due to calculi, the treatment will be that outlined under nephro-lithiasis; if due to the fetid and ammoniacal urine of cystitis, vesical irrigation and drainage may be necessary. The internal administration of salol or boric acid in 5 to 10 gr. doses is advised, not as a therapeutic measure, but to improve the condition of the urine. Acid urine offers no little resistance to fermentation and decomposition.

The diet should be carefully regulated and the skin and bowels made to act freely in order to relieve the kidney as much as possible. Internal medication has met with but little success because the affections are largely mechanical, or at least secondary to lesions lower in the urinary tract. Simple pyelitis and pyelonephritis are more amenable to the therapeutic action of medicines. Those oftenest indicated are lycopodium, belladonna, uva ursi, cannabis sativa, cantharis, terebinthina and saw palmetto. If internal medication affords no relief—and usually it does not in these conditions—operative measures must be tried. Nephrotomy and drainage of the pelvis may be all that is necessary to relieve purulent pyelitis. Or, if the patient's condition is very bad, nephrotomy and drainage may tide the patient over the imminent danger, and subsequent nephrectomy can be accomplished with less hazard. In some desperate cases bilateral exploratory nephrotomy may be justifiable. The method

of performing this operation has been described, and it merely requires that a drainage tube or a tamponade of iodoform-gauze be placed in the wounded kidney and the pus conducted out through the lumbar wound left open for this purpose. Of course this may lead to a urinary fistula, which may heal spontaneously in a few weeks or months; if not, nephrectomy will probably be necessary. Or, at the primary exploration, if the kidney be found practically destroyed or much enlarged and filled with calculi or pus it may be removed. Increase in the size of the kidney, especially if occurring at the time the pus diminishes or disappears from the urine, increase in the gravity of the systemic disturbance, as evidenced by fever and pyuria, perhaps intermitting, are further indications for extirpating the kidney. When the kidney is thus damaged by disease and its excretory function is destroyed its extirpation can have no effect in increasing the labor of the other kidney.

NEPHRECTOMY. Probably the most important precaution to be observed before this operation is to determine the existence of the other kidney and its functional activity. For this the surgeon is again referred to Examination. The necessity for ascertaining these facts is responsible, to a considerable degree, for the extensive discussion on the choice of the incision for nephrectomy. The vertical lumbar incision previously described may give sufficient room; if not, another incision, starting from the one already made, may be carried forward transversely, and toward the umbilicus, ending at the outer border of the rectus muscles. All the muscles are separated down to the peritoneum, which may be crowded forward. At times the transverse incision is used alone; again, to the transverse may be added a short vertical incision. In certain cases it has been deemed advisable to resect the two last ribs in order to gain working room. The kidney is sometimes reached through the ordinary laparotomy incisions—i. e., through the linea alba and linea semilunaris. These, of course, offer the transperitoneal route and, like the transverse, which is carried through the peritoneum when necessary, afford an opportunity for direct palpation of the other kidney and its presence, and to some extent its condition, can thus be determined. If the kidney is much enlarged the transperitoneal route may be the only one through which it can be removed. The lesion demanding operation and the peculiarities surrounding it must determine the choice of incision. By whichever route the kidney is reached the final manipulations are much the same. If inflammatory changes have not united the kidney to the structures surrounding it the fingers are swept around both its extremities and convex border till it is entirely freed except for its attachment with the ureter and renal vessels. These are ligated, either en masse or in sections, with strong silk or chromated sheep-gut, passed with a blunt, full curved aneurism needle. Silk ligatures are occasionally left long and brought out through the wound. The artery may be ligated separately if feasible. Sometimes a clamp is applied to the pedicle till the kidney is removed, when more space is obtained for further manipulations. Too much traction must not be made in endeavoring to bring the kidney into the wound, as it is possible to tear the vessels. The operator should be especially cautious if the kidney is surrounded by adhesions; the effort to tear through these may tear the peritoneum. Even the colon and vena cava have been thus wounded. If a portion of

the kidney is adherent to the peritoneum the major part of the organ may be removed and then the adherent portion gently picked or scraped off. Or, if only a portion can be separated the rest may be allowed to remain. Partial excision may likewise be practiced when only a part of the kidney is diseased; the gap or raw surface should be united with sutures.

Whether any attempt should be made to close the muscular wound must depend upon the peculiarities of the case. It is generally considered safer to pack with iodoform-gauze, drain, and allow the wound to heal from the bottom. If there is fair promise of non-infection of the wound sutures may be introduced, left untied, and the wound packed. The packing can be removed in about forty-eight hours and if the wound is perfectly sweet it may be closed by secondary coaptation. If the transperitoneal or abdominal route were chosen, the viscera is crowded aside and the peritoneum stripped from the kidney and its vessels ligated. The blood supply to the colon is thought to be interfered with unless the second incision in the peritoneum be made on the outer side of the colon. The kidney is shelled out by means of the fingers. Lumbar drainage is provided for by a tube or gauze packing. The anterior abdominal wound may be closed as usual. Or, in extreme cases, the posterior peritoneal gap may be left unsutured, a large tamponade of iodoform-gauze rapidly pressed down upon it and brought out through the abdominal wound, which is only partially sutured, as after ordinary laparotomy. In all instances the first dressing should be abundant.

CHAPTER IV.

RENAL TUBERCULOSIS—HYDRONEPHROSIS.

Renal Tuberculosis.—Renal tuberculosis may occur as a primary lesion or coincidentally with uro-genital and general milliary tuberculosis. It frequently begins in the testicle, seminal duct, prostate or bladder, and ascends to the kidney, where its pathological changes are practically the same as described with tuberculosis of various other structures. When the kidney is the primary seat of the disease infection is supposed to have taken place through the blood. It has been found both in the pelvis and cortex of one or both kidneys.

SYMPTOMS. Unfortunately the symptoms strongly resemble those of other vesico-renal maladies; for even when occurring primarily in the kidney, vesical irritability is quite likely to be a prominent symptom. This may be in part reflex, or possibly due to incipient infection, or to the irritating presence of Koch's bacilli and their ptomaines, which are washed down from the kidney. A slight involvement of the kidney is believed to be compatible, for some years, with a fair degree of health. When one kidney is extensively involved with accompanying invasion of ureter and bladder, and particularly when the affection is bilateral, the constitutional symptoms are well marked. Chills or chilliness with elevated temperature, more or less irregular, together with emaciation, are characteristic. The patient suffers from general malaise, and while there may be aggravations and exacerbations there is always more or less distress—unlike the patient with the calculous kidney. The latter is often quite comfortable between his attacks of colic.

DIAGNOSIS. It is frequently difficult to differentiate between tuberculous and calculous pyelitis, for the urine presents many of the same characteristics. The chief distinguishing features are that the urine from a tubercular kidney is free from uric acid crystals and contains caseous material, and although there is slight hematuria it is not persistent and is not so likely to be aggravated by exercise and ameliorated by quiescence. Both conditions may have the frequent micturition, but calculi may, with a reasonable degree of certainty, be excluded if the patient has but little colic (and that quite susceptible of relief), which does not retract the testicle, and if there is a family history of phthisis or a personal history of previous tuberculous involvement of glands, joints, bones or lungs. Prolonged and thorough search generally reveals tubercule bacilli in the urine. The calculous patient is likely to have a history of lumbar pain and tenderness, sharp attacks of colic associated with or succeeded by hematuria, and the passage of gravel. The patient is quite likely to be gouty, with perhaps a family history of gout, and the urine contains the crystals indicative of calculi.

When feasible, ureteral catheterization and cystoscopy should be employed, although palpation will generally reveal the tenderness of the affected kidney. As a rule it is not much enlarged. If an exploratory

incision is made the characteristic shot-like tubercles may be felt on the renal capsule, and on section pouches varying in size will be discovered filled with putty-like masses of caseous pus.

TREATMENT. If the diagnosis is made early the patient should be given the best possible anti-tubercular diet and medication. Codliver oil, cream, butter, and the yolk of the egg are to be recommended as among the most wholesome fats. Climatic change should also be advised. The symptoms are covered by the remedies suggested for pyelonephritis with the addition of calcarea jodata, arsenicum jodatum and phosphorus. The author has fancied that the internal administration of iodoform has been followed by improvement, but its use is not yet sufficiently extensive to warrant its recommendation. One of the most frequent errors is that of local treatment, urethral and vesical. This usually aggravates the symptoms.

If the renal malady is but a part of a general milliary tuberculosis, no operative measures are of any avail and of but little, if the ureters and bladder are involved. Of course, in the latter case, drainage of the renal pelvis puts the infra-renal structures to a greater or less extent, at rest and consequently may afford the patient some relief. If the patient is growing progressively worse the kidney may be explored and, if practically destroyed, removed.

If a considerable portion of it is found to be normal a partial resection may be performed. (See Nephrectomy.)

Hydronephrosis.—This term is applied to an accumulation of non-purulent fluid within the dilated renal pelvis and calices. It occurs congenitally and by acquirement. Instances have been recorded in which its prenatal size was sufficient to obstruct parturition.

CAUSES. It is claimed that congenital dilatation without obstruction has been noticed; but it is quite safe to say that it is habitually associated with obstruction. The ureter may be contracted, twisted, kinked, blocked by calculi, granulations, cysts, papillomata, etc., or, in some cases, a valve-like fold of mucous membrane is found at the junction of the renal pelvis and ureter. Obstruction in any portion of the urinary tract, and especially if attended by frequent efforts at micturition, have produced it in some degree. The same is thought to be true of phimosis. Pressure from tumors, ovarian or uterine, have likewise caused it. If the obstruction be urethral or vesical both kidneys will naturally be affected.

Of all the causes obstruction from calculi is most frequent. The accumulation is generally gradual, and by its pressure causes the dilatation of the pelvis and absorption of the parenchyma. (Fig. 665). This sometimes reduces the kidney to a mere sac, containing anywhere from an ounce to a gallon of thin amber-colored fluid, generally containing a little urea, albumin and mucin. In one case reported the sac contained thirty gallons. (Gross.)

An acute or intermittent obstruction is the more likely to be attended by an excessive accumulation, because in long-standing cases the excreting tubules are destroyed.

SYMPTOMS. A mild degree of hydronephrosis may manifest itself only by a dull ache or a sense of discomfort in the loin. The more sudden obstruction, with its greater accumulation, is attended with intense pain. The tumor, beginning under the last rib, increases in size and bulges

forward. Occasionally it disappears suddenly, accompanied by an excessive discharge of fluid through the bladder and urethra. Such intermittent hydronephrosis is thought to be due to the straightening of a kinked

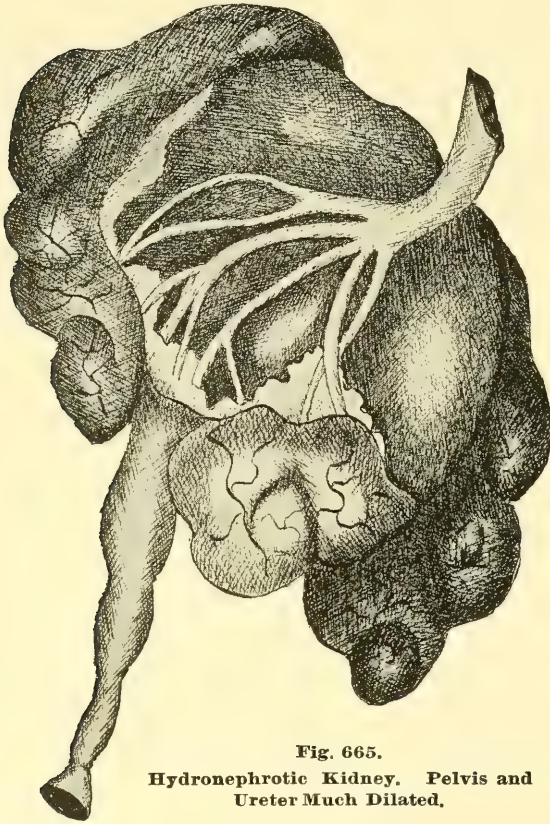


Fig. 665.
Hydronephrotic Kidney. Pelvis and Ureter Much Dilated.

or looped ureter, the passage of a calculus, the raising of the valvular mucous fold, etc.; and re-accumulations of the fluid may occur. If unilateral the sound kidney generally hypertrophies and compensates; if bilateral the urine is diminished or suppressed and uremia ensues. The prognosis naturally varies with the cause. If due to pressure from a malignant growth or an ovarian or uterine tumor the prognosis will be such as belongs to the causes plus the complication of hydronephrosis. The unilateral and intermittent type is the more favorable. Exhaustion and organic pressure-symptoms or rupture into the lung or peritoneal cavity are all matters of actual occurrence. Hydro- and pyonephrosis may be combined.

DIAGNOSIS. The hydronephrotic kidney may be so large as to simulate ascites. If of appreciable size fluctuation is readily discoverable. The position from and direction in which it grew, its attachment to the posterior abdominal wall, and its relation to the colon in front are its characteristics. If to this are added the symptoms above enumerated the diagnosis is reasonably certain. It may be rendered more so by aspiration through the loin and an examination of the fluid, which will usually be found to contain a slight amount of urinary solids, and perhaps renal epithelia. In very old cases, however, this may not be possible.

TREATMENT. When dependent upon pelvic or abdominal pressure, such as an enlarged or retroverted uterus or an abdominal tumor, these conditions must be treated first. When the fluid accumulation is of a sufficient degree to be easily demonstrable gentle massage, lifting of the tumor, inversion, change of position, kneading and stroking of the ureter and warm baths are in order. Lumbar aspiration is also practiced. If phimosis exists it should be relieved. Lumbar incision (see Nephrotomy) and drainage offer more advantages, as they permit of an examination of

the renal pelvis and perhaps the discovery and removal of the cause. The sac should be thoroughly explored with the fingers before stitching. If any of the kidney tissue is still capable of functioning, nephrotomy is likely to be followed by a urinary fistula. If this becomes unendurable and the opposite kidney is performing the added amount of labor cast upon it, the hydronephrotic kidney may be extirpated after it has contracted, as it eventually does. Primary nephrectomy may be done, but is usually difficult on account of dimensions of the cyst. If the cyst is reached by the transperitoneal route it will be treated as any abdominal cyst. The peritoneal cavity is walled off with sponges or gauze pads, the cyst evacuated and its sac stitched to the skin and drained.

CHAPTER V.

PERINEPHRITIS AND PERINEPHRITIC ABSCESS.

Definition.—Perinephritis is an inflammation of the adipose and cellular tissue surrounding the kidney.

Causes.—It occurs primarily as do abscesses in other structures, but is far oftener consecutive to infection or injury of other organs or tissues. It has been known to have its origin in inflammation and supuration of the appendix, vertebræ, gall-bladder, colon, etc. It is sometimes the sequel to the acute infectious fevers and puerperal sepsis. With these latter the affection is not unlikely to be bilateral. Prominent among the causative influences are the various forms of traumatism, septicæmia, exposure, renal calculi and tuberculosis.

Pathology.—The kidney being in relation, anteriorly, with the peritoneum, lies with its posterior surface and borders in contact with its loose cellular and adipose capsule. When inflammation and suppuration begin in this capsular tissue the resulting pathological changes are quite likely to be extensive on account of the looseness of the structures and the readiness with which inflammation and suppuration can spread. It is not rare, therefore, to find the whole peri-renal capsule converted into a thickened irregular suppurating mass to which the fibrous capsule of the kidney has become adhered. In cases that have existed for some time the latter capsule may also be thickened. The pus is sometimes urinous from its connection with the kidney and may be fetid, as are many abscesses that lie in juxtaposition to the intestines. Unless the pus is walled in by a protective zone of inflammation it very readily burrows downward toward the iliac fossa and upward toward the diaphragm, though usually remaining extra-peritoneal. It rarely makes its way through the peritoneum, but not uncommonly breaks through the posterior abdominal wall and is evacuated above the crest of the ilium.

Symptoms.—Pain in the loin, either continuous or remitting, is nearly always a prominent symptom. It is sometimes dull and aching in character, aggravated by pressure and motion, and the patient is often constrained to draw up the thigh and bend the body forward and toward the affected side, in order to obtain as much muscular relaxation as possible. Any motion that brings the psoas muscle into play causes excruciating pain. The pain, in some cases, radiates down to the hip or knee-joint, or to the genitals, and may cause retraction of the testicle. The urine is generally normal unless the peri-renal lesion is secondary to organic involvement of the kidney, when it will contain pus and other evidences of pyelitis. Suppuration is generally, though not always, ushered in with a chill or chilly creeps along the spine, and irregular fever and sweats supervene. Usually the bowels are obstinately constipated. Locally, bimanual palpation reveals exquisite tenderness in the lumbar region, and frequently a tumor of considerable size. The overlying skin becomes edematous as the pus increases in quantity, and makes its way toward the surface,

when there is noticeable bulging of the loin and, later, redness and fluctuation are marked. Its spontaneous or surgical evacuation here is quite likely to be followed by a perinephritic sinus or urinary fistula.

Diagnosis.—Until pus has formed the diagnosis is likely to be tentative, especially if the lesion is secondary; for in such a case the primary affection may mask the peri-renal changes. It has been confused with hip-joint disease on account of the referred pain and the position of the thigh, but a carefully localized area of tenderness, swelling and fluctuation just below the ribs is not significant of hip-joint disease. Pyonephrosis and hydronephrosis might be mistaken for perirenal abscess, but the latter is usually more acute, and careful watching of the urine will render valuable aid in this differentiation. Extraperitoneal aspiration through the loin is employed to verify the diagnosis. Solid growths of the kidney can be recognized by their freedom from fever, consistency, and their characteristic tendency to bulge forward. The perinephritic abscess is essentially retro-renal. The prognosis must depend largely upon the cause. In primary perinephritic abscess the prognosis is good; in the secondary the prognosis must accord with the gravity and continuance of etiological factors.

Treatment.—If diagnosed early absolute quiet in bed should be insisted upon. Hot applications to the lumbar area are generally employed but are of questionable utility because of the depths of the affected tissue. Arsenicum album, bryonia, belladonna, hepar and chininum arsenicum are the remedies usually indicated. As much light, nourishing and easily-assimilable food as is compatible with the accompanying pyrexia should be administered.

Later, if pus is suspected, free incision (down to and into the perinephric fat if necessary) is the wisest course. Such a step may, of course, be preceded by the introduction of the exploring needle. Pus can thus be found and evacuated long before it can be detected by fluctuation in the loin, and much time is saved and suffering is avoided by giving the pus a direct egress rather than waiting for it to burrow its way out or into other cavities or viscera. When the peri-renal fat is incised the kidney should be thoroughly palpated, punctured with a needle if necessary, and if the suppuration is dependent upon endo-nephritic causes then the kidney must be incised and drained. (See Nephrotomy.) This is the wisest measure even when the kidney is sufficiently diseased to warrant its removal. If nephrectomy is necessary it is prudent to do it after the symptoms of the acute affection have subsided.

As much as possible of the suppurating, sloughing and infected mass should be removed and the wound thoroughly irrigated with an antiseptic solution. If the kidney is suppurating and has been incised the drainage tube should be placed in this incision and the muscular wound packed and only partially closed.

CHAPTER VI.

URINARY FISTULA AND PERI-RENAL SINUS.

Primary Considerations.—Renal and peri-renal suppuration often lead to the discharge of pus and urine, or both, upon the free surface of the body. If urine escapes the condition is known as urinary fistula. When the opening leads into the fatty capsule only it is a peri-renal sinus. Such openings are most frequently found in the loin, but occasionally are found in the groin, perineum, and more rarely the intestines, pleura and stomach. As evidence of the latter, both urine and renal calculi have been vomited from the stomach.

Causes.—In the main, the causes are calculous and tubercular pyelitis and both primary and secondary perinephritis. Of course traumatism, gunshot wounds, stabs and surgical operations may be followed by a fistula or sinus. In nearly all cases there is a marked disposition for the surgical opening to heal unless some offending object is left within to perpetuate the cause, as a calculus for instance. Both urinary fistula and peri-renal sinus may be somewhat intermittent; they apparently heal and then break open again. Surgical fistulae are sometimes necessary as a temporary measure in certain renal affections, like hydronephrosis. The urinary fistula can be diagnosed by the urinous odor and the phosphatic deposits upon the granulations or hairs about the track. Attention may also be called to it if the patient has been taking some of the preparations of iodine (potash, e. g.), which, eliminated in the urine, forms the iodate of starch when it comes in contact with the patient's starched clothing. There are recorded rare instances of vesical and urethral fistulae opening in the loin and inguinal region. If any doubt exists as to this point creolin, milk or any non-irritating colored fluid may be injected into the bladder to note if the latter communicates with the fistulous opening.

Treatment.—In more or less hopeless cases when the fistula is discovered leading into some other viscus or organ, a fistula of expedience may be effected by a lumbar nephrotomy, to divert the urinary flow. The latter fistula is the more amenable to treatment than the former which may heal spontaneously when the urine no longer flows through it. Nephrectomy may be required in either case. If, as above suggested, the fistula is maintained by the presence of a calculus, the latter must be removed. Ureteral obstructions must also be relieved. If the opening has persisted for a long time the walls may have become so dense and hard that something more than the removal of the cause is necessary. Injections of iodine and iodoform emulsions (in the case of tuberculosis) and mopping the walls of the track with pure carbolic acid can be tried. If the urinary fistula persists and renders the patient miserable in spite of all other treatment and the opposite kidney is sound, nephrectomy of the diseased kidney is justifiable. Free incision and thorough clearing out of the pus cavity, and curetting or even cutting out the walls of the track with more direct drainage may suffice for the simple sinus.



Fig. 2.

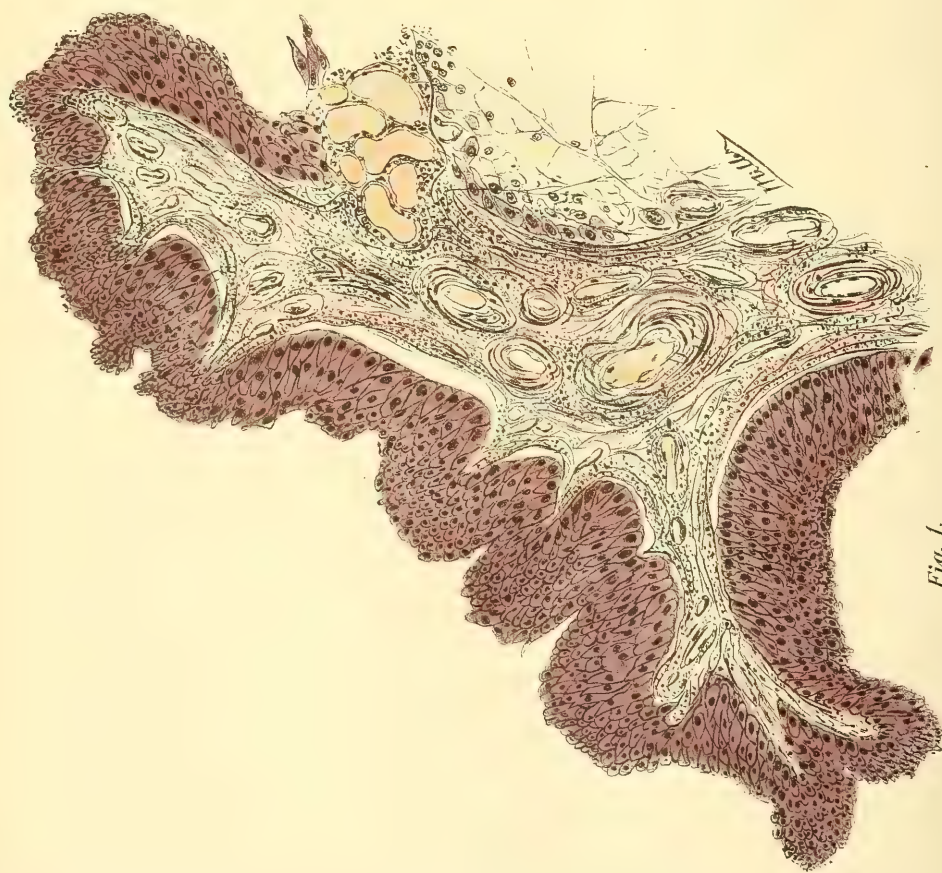


Fig. 1.

CHAPTER VII.

TUMORS OF THE KIDNEY.

Solid Growths.—The solid neoplasms of the kidney are generally carcinomata and sarcomata. Lymphadenomata, fibromata and lipomata occur from time to time, but inasmuch as their differentiation is impossible and their symptoms and treatment practically the same, their division and separate study have but little surgical importance.

Sarcomata are often found in the young and may be congenital and grow to no inconsiderable size. (See Fig. 666). The carcinomata are usually found in adult or advanced life and seem to have a predilection for movable kidneys.

SYMPTOMS. As a rule the symptoms are those dependent upon the mechanical influence of the tumor, and consequently it often attains a large size before the attention of the surgeon is called to it. There is usually pain in the loin, either dull and aching, or at times sharp and paroxysmal, radiating down the branches of the lumbar plexus. Such an attack may simulate renal colic, especially as it may be attended with hematuria and irritability of the bladder. The hematuria, however, is uninfluenced by activity or quiescence, as in nephro-lithiasis.

By manual examination a hard rounded tumor can be felt through the flank and as it bulges forward may be seen to elevate the anterior abdominal wall when the patient is lying upon the back. Occasionally the urine contains shreds which seem to be cast off by the growth. This is true particularly of the papilloma which presents about the same characteristics as the vesical "villous" growth. (See Plate XX, Fig. 2.)

DIAGNOSIS. One of the difficulties in the way of diagnosis is that the urinary analysis generally yields negative results; this is helpful, though, in excluding other renal affections which have their urinary characteristics. The methods of examination outlined in a previous chapter should be studied and every effort made to arrive at a positive diagnosis; for unless these growths are treated early it is practically useless to treat them at all.

TREATMENT. The treatment consists of the removal of the tumor and with it the kidney. Nephrectomy will not be undertaken if the malignant growth of the kidney is secondary, or if generalization has ensued. Otherwise, removal may be attempted, even though hazardous, for the patient is doomed unless extirpation is possible. Neither the operative chance nor the post-operative outlook for immunity is very promising, but they are the best that surgery can offer at present.



Fig. 666.
Sarcoma of Kidney.

The transverse incision and the peritoneal route are employed for the large growths, especially in children. It was formerly deemed unjustifiable to subject children to this operation, but recently it has been attended with considerable success. The removal should be extra-peritoneal if possible; if not, then the transverse incision may be carried to the border of the rectus abdominis and through the peritoneum. The latter is incised freely, the pedicle clamped and the tumor cut away. More room is thus obtained for properly ligating the pedicle in sections. If the condition of the patient admits, the peritoneum may be sutured

over the site of the tumor; if not, it may be pressed upon by gauze tamponade carried out upon the skin surface.

Cysts.—Cysts of the kidney are congenital or acquired, and are found in one or both kidneys. There may be only one cyst or the kidneys may be only a mass of cysts (polycystic kidney, conglomerate cysts or cystic degeneration). (Fig. 667). The multiple small cysts are thought to be expanded tubules or Bowman's capsules, resulting from obstruction in certain forms of nephritis.

The congenitally cystic kidneys are practically instances of arrested development, as there is but little renal structure to be found. The kidney is often represented by a much enlarged mass of cysts varying in size from that of a marble to a pin head. The mass may be so large as to obstruct parturition. Occasionally the liver and spleen as well as the kidneys are poly-

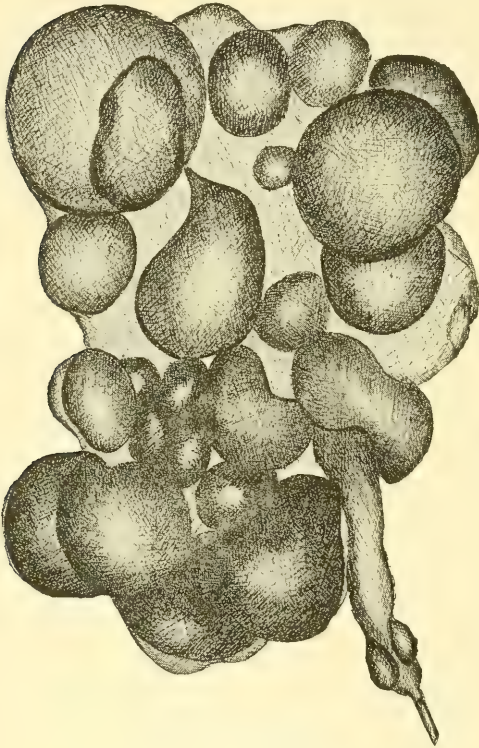


Fig. 667. Polycystic Kidney.

cystic. The symptoms and course of the above affections are practically those of deficient urinary excretion and uremia and are not amenable to any form of treatment.

The solitary or isolated cysts are found ranging in size from that of a hen's egg to a cocoanut. They manifest themselves usually by pressure-symptoms. (Pressure upon the kidney or other organs and structures.) Such cysts are not easily differentiated from hydatid cysts or hydro-nephrosis, but the treatment in either case is practically the same. The treatment consists of aspiration (frequently repeated if necessary), incision and suture of the sac to the abdominal wound, drainage, and nephrectomy, according to the condition of the patient and the urgency of the symptoms.



Microscopical Section. Halphide.

1. Ureter.
2. Supra-Renal Capsule Distended with Liquid.

PLATE XXI CARCINOMA MOLLE.—BURT.

HYDATID CYSTS.

The manifestations of this variety of cyst are similar to those described above. A differential diagnosis is possible only by spontaneous evacuation, exploration and aspiration, and the discovery of the characteristic hooklets in the fluid. These not infrequently escape through the ureters and bladder, attended by symptoms of renal colic; such is the tendency of the cysts to rupture into the renal pelvis. This furnishes quite positive evidence as to the nature and

location of the tumor; although cysts of the liver and other structures have, with extreme rarity, ruptured into the ureter or renal pelvis. They have also ruptured into the lung and the hooklets have been coughed up.

The hydatid thrill sometimes felt after percussion with the finger may be occasionally elicited, but its non-discovery does

not exclude this form of cyst. The treatment is repeated extra-peritoneal aspiration through the loin; if this fails, incision, drainage, or nephrectomy. The latter will be indicated if the kidney is, to a considerable extent, destroyed.

If the cyst cannot be extirpated and is sufficiently large its walls should be

treated as any variety of abdominal cyst; i. e., stitched to the outer wound, drained, and allowed to close by granulation.

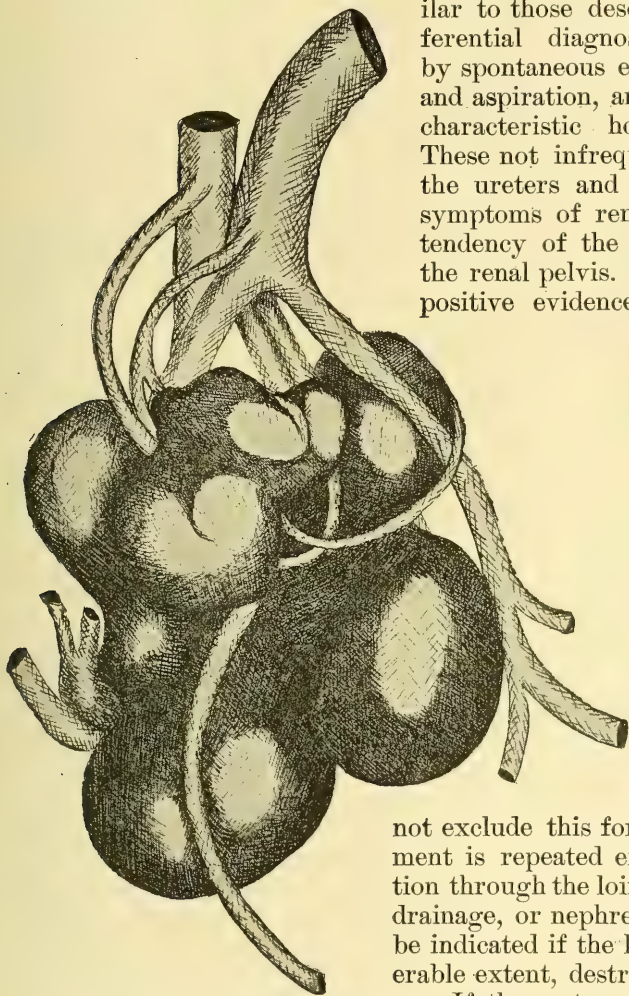


Fig. 668. Single Kidney Fused into Shapeless Mass.

CHAPTER VIII.

WOUNDS AND INJURIES OF THE KIDNEYS.

Penetrating Wounds.—Gunshot wounds of the kidney are more frequent than any other variety of open wounds, although renal injuries are inflicted with knives, bayonets, or other pointed instruments or objects. They are usually inflicted from behind or from the side. The character of the injury varies with the cause. If a bullet, it may, by its deflection, wound the kidney even though it enters the body at a point remote from the kidney. If from the posterior or lateral position the peritoneum generally escapes injury, but not always; for the vulnerating body may penetrate the kidney and through the kidney enter the peritoneum, the result being a wound which is both extra- and intra-peritoneal. Most frequently they are inflicted in the lumbar region and are extra-peritoneal. Incised wounds of the kidney usually show a greater tendency to heal than those caused by a bullet. As stated in another chapter, the wounds of the renal parenchyma are much more likely to heal without resulting fistula than are those inflicted through the renal pelvis.

SYMPTOMS. The local symptoms are those of a wound of any other living animal structures plus shock and, perhaps, escaping urine.

The pain varies, depending upon the extent of the wound and the tissues through which it was made. As in other renal affections the pain is often transferred to the groin, thigh and testicle; the latter may be drawn up as in nephro-lithiasis.

Hemorrhage is not likely to be of a serious character unless some of the vessels in the region of the hilum are injured. The parenchymatic wound is not usually attended with profuse hemorrhage. Hematuria and extravasation of blood into the loose connective tissue about the kidney are of frequent occurrence. Blood may also escape along whatever course the vulnerating body may have pursued. When thickened or clotted its escape through the ureters is attended with symptoms of renal colic and vesical tenesmus.

Occasionally the kidney protrudes into or through the wound. It should be replaced unless injured sufficiently to justify its removal. The urine may escape through the wound continually or intermittently, perhaps dependent upon the clogging of the ureters with blood-clots. The shock is usually out of proportion to the apparent injury. Nausea and vomiting are frequent.

TREATMENT. The same surgical principles apply here as elsewhere. (See Shock.) A thorough cleansing of the wound is important. If the hemorrhage is profuse, whether internal or external, the wound should be enlarged, the kidney exposed, and the bleeding wound closed with sheep-gut sutures. If necessary, the large vessels can be clamped while the kidney is being examined and sutured. A careful search should be made for foreign bodies which, of course, should be removed. If the wound is in the renal pelvis the clots should be cleared out and a probe

or catheter passed down the ureter. A stream of irrigating fluid is useful in clearing the latter. The wound may be partially closed, packed and drained, according to the nature of the wound. (See Nephrotomy.) Perinephritic suppuration, fistula and sinus, which may ensue, are treated of under their respective headings. If the kidney is so injured that its function is greatly impaired or destroyed, its extirpation must be considered. (See Nephrectomy.)

Contusions and Sub-Parietal Lacerations.—This form of injury is usually the result of falls, blows, kicks, jars, or the application of some crushing force, as, for instance, railroad accidents. This variety of renal trauma is of more frequent occurrence than the one previously described. The injury varies from a slight sub-capsular hemorrhage to a complete rupture of the kidney, or it may be pulped. The peritoneum generally escapes laceration, though the spleen, liver, intestines and ureters are occasionally torn. Suppression of urine and thrombosis of the renal veins have been noted in rare instances.

SYMPTOMS. The symptoms are the same as in the preceding injury except that the pain is generally less acute and the hemorrhage is hidden. The bladder may fill with blood or it is extravasated into the renal substance or the fatty capsule. This may be excessive, resulting in the formation of large-sized hematmata. The urine frequently infiltrates the peri-renal tissues, and abscess and fistula result. Or both blood and urine may burrow downward behind the peritoneum and into the true pelvis or scrotum.

TREATMENT. The shock is usually extreme and will be treated according to the rules found under surgical shock. If the injury is not very extensive recovery is the rule; the only treatment required being quiet in bed with light, non-stimulating diet, and the administration of arnica, rhus tox., or hamamelis. Bandaging or strapping the injured side will serve to tranquilize it. If blood collects and becomes clotted in the bladder it can be removed through a large catheter, or better, through an evacuating tube such as is used in connection with vesical litholapaxy; if necessary, cystotomy may be resorted to. Hydronephrosis (from clogging of the ureter) may be treated by aspiration. A hematocele may be evacuated in the same way.

A severely lacerated kidney, attended with profuse hemorrhage, may result fatally in a short time, and therefore demands prompt treatment. The operative measures are the same as for the preceding variety of renal injuries.

CHAPTER IX.

URETERAL CALCULI--URETERAL STRICTURE--URETERAL WOUNDS.

Ureteral Calculi.—These usually originate in the kidney and find their way into the ureter where they lodge. They may be arrested at any point along the ureter, but most frequently they are found at the junction of the ureter and renal pelvis and at the uretero-vesical junction. It is claimed that the ureter is narrowed also midway in its course and presents a suitable lodgment for a stone. A roughened or craggy calculus may so irritate the mucous membrane that a spasm of the ureter may occur and the calculus be grasped and become fixed.

Ureteral calculi occur in one or both ureters and may be single or multiple. A calculus in one ureter is capable of causing, reflexly, suppression of urine in the other kidney. If the obstruction is complete ureteral dilatation and hydronephrosis necessarily ensue; if only partial, the renal function may not be interfered with. The ureter is generally much thickened around the impaction.

The stone may ulcerate its way through the ureter and escape with the urine into the surrounding tissues. Thus abscesses are produced, the pus from which may burrow in almost any direction, through the loin, into the plural and peritoneal cavities, into the intestines, etc.

SYMPTOMS. The symptoms are practically those of an attack of renal colic. (See nephro-lithiasis). The attack, however, is not characterized by the sudden cessation that ensues when the stone passes into the bladder. The intense pain may subside somewhat and is followed by localized pain and tenderness.

DIAGNOSIS. If the calculus is arrested at the uretero-vesical junction it may be possible to feel it through the wall of the rectum in the male, or vagina in the female. If the calculus is of considerable size, palpation in a thin subject may be of service. It has also been located by the hand in the abdominal cavity. The diagnosis is strengthened if the patient is of the uric acid diathesis and has previously passed calculi.

TREATMENT. The prophylaxis and treatment of the acute attack are the same as for nephro-lithiasis. If the symptoms and deterioration in health persist in spite of all treatment, operation is necessary. If the area of tenderness is within the first three inches of the ureteral course the stone is removed by an incision along the outer edge of the quadratus lumborum muscle. In short, fat subjects where the crest of the ilium and ribs are nearer together than normal this route may not provide sufficient space for exploring the ureter. If the ureter is exposed by this incision and a calculus discovered, the ureter is incised longitudinally (ureterotomy) and the stone removed. (Uretero-lithotomy.) A sound or catheter should be introduced into the ureter in both directions to ascertain if any further obstruction exists. The ureter has been success-

fully sutured, and although ureteral fistula may ensue, spontaneous closure is generally expected, the muscular wound being packed, drained and dressed as for operation on the kidney. The calculus engaged at the uretero-vesical junction can occasionally be felt by the sound in the bladder, and in the female may sometimes be removed by forceps passed through the dilated urethra. If this fails it must be removed, as from the male, through a vesical incision—supra-pubic or perineal in the latter, supra-pubic or vaginal in the former.

In other instances the calculus may be impacted below the pelvic brim in such a position as to be accessible only by the abdominal route, by Cabot's modifications of Kraske's resection of the sacrum, or by the sub-peritoneal route through an inguinal incision. Whenever possible, the impaction should be removed through the extra-peritoneal route which may be combined with an abdominal section. The latter affords the best means of diagnosis, as both kidneys and both ureters can be palpated. Calculi can be removed by the abdominal route, but even after suture of the ureter and the overlying peritoneum there is serious danger to the peritoneal cavity from escaping urine, especially if from a diseased kidney. Consequently a tamponade of iodoform-gauze should be carried from the wounded ureter out through the cutaneous incision. Or, inasmuch as uretero-lithotomy may at times necessarily follow a nephrolithotomy, a preliminary nephrotomy with drainage might be employed previous to the trans-peritoneal uretero-lithotomy. This would insure, to a considerable degree, against ureteral leakage into the abdominal cavity.

Ureteral Stricture.—TREATMENT. It is recommended that strictures in the continuity of the ureter be slit longitudinally and the upper and lower angles of the wound brought together, thus converting a longitudinal wound into a transverse.

If the stricture is close to the bladder or renal pelvis it is sometimes possible to dilate it with small elastic bougies introduced through the pelvis or bladder. Number 8 or 9 in the French is a suitable size to begin with. Neither bougies nor catheters can be left in the ureter for more than a few hours or a day or two without producing ureteral irritation and inflammation. At least, this is the rule. What amounts to the same thing as a stricture is the existence of a valve-like fold of mucous membrane at the junction of the ureter and the renal pelvis. This has already been mentioned as a cause of hydronephrosis. When such an obstruction is discovered attempts should be made to obliterate it. Sometimes discovery is possible only by lumbar nephrotomy and an infra-renal ureterotomy through which a probe is passed into the pelvis. To accomplish this the valvular mucous fold is incised longitudinally and the flaps drawn apart and united to the inner wall of the pelvis (Kuster and Trendelenberg), or, the corners of the incision are stitched together, making the wound transverse instead of longitudinal. (Fenger.)

Wounds of the Ureter.—Although the surgery of the ureters is yet new and therefore quite likely to be modified, it is essential that the surgeon should be conversant with it because the nature and position of the ureters render them quite likely to be wounded. This is especially true in abdominal and pelvic operations, even when the surgeon is taking every precaution against inflicting ureteral wounds. Sub-parietal and penetrating wounds have the same etiology as wounds of the kidney.

DIAGNOSIS. The early diagnosis is difficult because of the variability of the symptoms. If the wound is an open one and the urine escapes, or if the injury is inflicted during the progress of an intra-peritoneal operation, the diagnosis is usually simple. The urine is discharged intermittently and in small quantities. In sub-cutaneous ruptures and even in some penetrating wounds, it may be impossible to make a diagnosis till too late to obtain the best results from ureteral operations. In these latter cases the symptoms may be hematuria, slight or profuse, and the usual pain, and later swelling. Hematuria may be transient or absent. Shock is not so marked nor is hemorrhage so profuse as in rupture of the kidney. In unseen ruptures the only symptom may be swelling. This is due to the accumulation and infiltration of urine about the rupture and is frequently a late symptom, at times undiscoverable for days after the injury.

TREATMENT. If the rupture is sub-parietal and is not suspected till the swelling makes its appearance, the latter should be punctured freely (and repeated if necessary), or free incision and drainage through the loin are better. This treatment is usually instituted at a period so remote from the time of injury that the ureters and peri-ureteral tissues are not in a promising condition for delicate reparative operations on the ureters. The tendency is toward ureteral stricture, at the point of rupture, and infection of the kidney; and nephrectomy may be indicated. If the rupture is due either to an extra-peritoneal traumatism or is coincident with an intra-abdominal operation, and is detected, it should be treated according to some of the following methods:

Longitudinal wounds are to be united by fine sheep-gut or extra-mucosal sutures and the wound packed with iodoform-gauze, to afford a drain for the possible leakage. This is applicable to both intra- and extra-peritoneal wounds. If there is considerable loss of ureteral substance and anastomosis and vesical or renal implantation are impossible, the proximal end of the ureter is to be dissected up for some distance, brought out through the lumbar region and attached to the skin. The distal end should be ligated and left in situ or brought out through the lower angle of the wound. Such disposal of the wounded tube, as well as its implantation on the skin of the abdominal wall, may be but a temporary expedient, to be followed by a nephrectomy at a later and safer period.

Ureteral implantation into any portion of the alimentary tract is so likely to be followed by renal infection that it is regarded as a questionable measure. If the wound of the ureter is in the vesical portion and is transverse and complete, the distal end should be closed and the proximal end implanted or invaginated into the bladder. Splitting the end of the ureter facilitates the attachment, and heaping the peritoneum about the new uretero-vesical junction lessens the liability to leakage. When the same character of wound occurs at the renal end of the ureter the latter is to be slit up on one side only, the end then flattened out and sutured to the renal pelvis. (Kuster.) If complete rupture occurs in the continuity of the ureter the best known treatment, up to the present time, is what is styled uretero-ureterostomy. This method was devised by Van Hook, and is performed as follows: The vesical portion of the ureter is ligated close to its divided end, and about one-quarter of an inch below the ligature the ureter is incised longitudinally. The incision should be long

enough to admit the renal end of the ureter, which demands a slit about twice as long as its diameter. (Fig. 669). This end is slit up for one-quarter of an inch and two fine cambric needles on the same sheep-gut

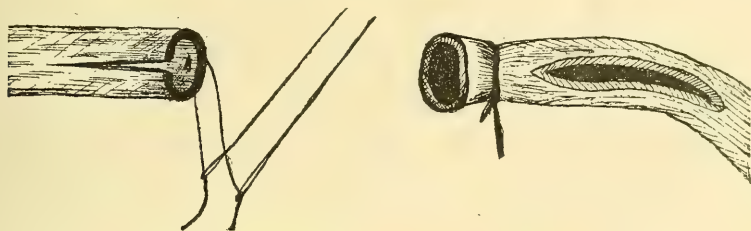


Fig. 669. Ureter Prepared for Anastomosis.

suture are then passed through its wall from within, outward. These needles are carried into the slit in the vesical end of the ureter and made

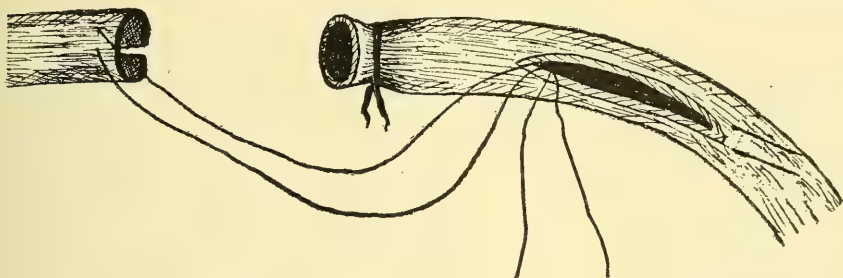


Fig. 670. Needles Emerging from Ureter below Slit.

to emerge at a point one-half inch below the lower angle of the incision. (Fig. 670). Traction upon these sutures draws the renal end of the ureter into the slit made for it, and it is retained by tying the suture. (Fig. 671). This operation, like all others for the repair of the ureters, should be extra-peritoneal whenever possible.

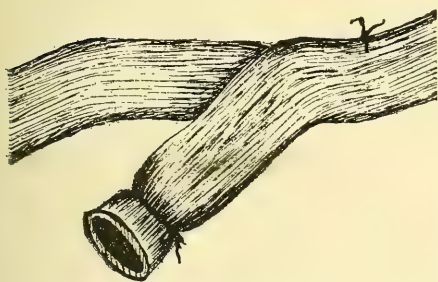


Fig. 671. Renal End of Ureter Drawn into Vesical End.

necessary. It is performed as follows: As much as possible of the ureter is dissected up through a lumbar incision, and the remaining portion is reached through an incision in the inguinal region, which permits of the stripping up of the peritoneum (as for ligation of the iliac vessels) and the isolation of the ureter. It is ligated at its junction with the bladder and cut off. The wound is closed, with provision for drainage. (Reynier.)

The after-treatment of the wound is the same as for nephrotomy, etc.

URETERECTOMY. Complete removal of the ureter has been found necessary after nephrectomy for suppurative pyelonephritis. The ureteral suppuration does not always subside, and ureterectomy may be

SECTION XXIV.
**SURGERY OF THE MALE GENITO-URINARY
ORGANS.**

**CHAPTER I.
THE PENIS.**

Definition.—The penis is composed of two parallel cylinders of erectile tissue, the corpora cavernosa and the corpus spongiosum beneath, containing the urethra and terminating in an enlarged extremity, the glans. The skin covering the organ is thin, and loosely connected to the underlying parts by connective tissue containing no fat. A prolonged fold forms the prepuce. The covering of the glans is firmly adherent and bears some resemblance to mucous membrane.

Abnormalities of the Penis.—**ABSENCE.** Congenital absence of the penis, with other organs developed, has been reported, but the condition usually results from gangrene or from amputation done for malignant disease or for the production of eunuchs. In some parts of the East eunuchs are made by closely cutting off the penis and the scrotum with its contents. Relief of the cicatricial contraction of the orifice of the urethra is all that can be done for such cases. In addition to dilatation the opening may sometimes be split on one side and a wedge of neighboring skin stitched into it so as to secure permanent increase in size.

CONCEALED PENIS. Instances have been observed where the penis instead of having a separate integument was in the scrotum or beneath the skin of the abdomen. Relief has been afforded by incising the overlying skin, disengaging the organ, and covering it with flaps taken from the neighboring skin.

Rudimentary and deformed conditions of the penis are commonly observed in hermaphroditism, in hypospadias and epispadias.

Injuries of the Penis.—**WOUNDS.** The penis is subject to all the varieties of wounds met with in other parts of the body. Hemorrhage, urinary extravasation, and subsequent curvature of the organ are to be guarded against and remedied. Bleeding vessels should be ligated, wounds coaptated and stitched; and, if the urethra has been opened a catheter should be introduced and retained till the opening has closed.

Strangulation is an accident to which the penis is particularly liable. Prompt removal of the cause is the remedy.

FRACTURE. Fracture of the penis is rupture of the corpora cavernosa, from violence during erection. Extensive extravasation of blood follows.

This should be combated with cold water and tight bandaging. If it has already occurred incision may be made to evacuate the blood before applying the bandage. If the urethra is involved in the rupture free urethral hemorrhage occurs. A catheter should be retained to avoid liability of urinary infiltration. Rest in the horizontal position with the organ elevated is most advantageous. Subsequent induration and obliteration of erectile tissue at the site of injury are apt to cause lateral curvature.

Dislocation of the penis into the scrotum or beneath the skin of the abdomen are curious accidents that have been reported.

Inflammation of the Penis.—**LYMPHANGITIS.** In gonorrhea one or more lymphatic vessels sometimes become inflamed and the lymphatic glands affected. The inflamed vessels may be felt in the beginning; later the whole organ becomes swollen, red and painful. Suppuration occasionally ensues. A more virulent inflammation is sometimes excited by chancroidal poison before it reaches the inguinal glands.

Treatment. At an early stage, continuous cold or hot applications; later, moist dressings. If suppuration occurs incision should be made and moist dressings continued.

Gelsemium, belladonna, hepar sulphur, and such other internal remedies as may be called for by the primary disease may be given. Rest in bed, with the organ elevated and the rectum kept empty by enemata, is a necessary condition for satisfactory results.

ABSCISS. Abscess may develop in the penis as well as elsewhere, and requires the treatment ordinarily given.

FOLLICULITIS. This is usually a chronic process. In chronic urethritis one of the follicles of Littre becomes occluded, and gradual accumulation of secretion causes a development similar to a sebaceous cyst. Later acute inflammation, suppuration and external discharge of contents may occur.

GANGRENE. This results from constriction, phagedenic ulceration or urinary extravasation. It sometimes develops in smallpox and typhoid fever. A ten per cent. solution of acetic acid has been an application most satisfactory to the author. Bovinine has been successfully used by others. The dead tissue should be clipped off with scissors as soon as the line of demarcation appears, and the wound dressed antiseptically. Arsenic or secale and good diet should be administered.

Tumors of the Penis.—Benign tumors are cystic, adenomatous, fibroid, vascular and elephantiasis. They are treated here as elsewhere. Penile elephantiasis is usually associated with that of the scrotum. If it is confined to the prepuce circumcision affords relief.

Malignant growths are usually of the epithelial variety, though scirrhus and sarcoma occasionally occur.

Epithelioma usually begins as a warty growth on the inner surface of the prepuce, or at its junction with the glans. There is little or no pain at first—simply a thickening and lack of pliability. Later phimosis occurs and an ichorous discharge comes from beneath the prepuce. The progress is slow, but finally ulceration, glandular enlargement and systemic infection take place. It generally occurs in men past middle age, and in whom there has been some local irritation. In several instances husbands have contracted it from their wives, the subjects of uterine carcinoma.

TREATMENT. The treatment is by removal of the growth—by circumcision when it is confined to the prepuce; by curettage and cautery, or by excision when it extends to the glans; by amputation if it has recurred after removal by other procedure, or if extensive disease or ulceration is present. If the inguinal glands are enlarged they should be removed.

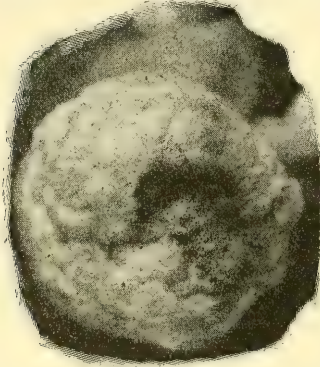


Fig. 672.
Epithelioma of Penis—Martin.

In amputation a skin flap of about one-half inch should be retracted, the corpus spongiosum and urethra cut one quarter inch longer than the corpora cavernosa, the corpora cavernosa ligated with silk-worm gut carried out through the skin to be tied and the urethra dissected from the spongy body, which is cut back to the extremities of the cavernosa, the urethra being split above and below and stitched to the skin. Amputation by galvano-cautery has been done, but the stump is liable to subsequent cicatricial contraction about the orifice of the urethra, hence it is not in favor.

Phimosis.—Phimosis is contraction of the prepuce anterior to the glans penis. It is congenital or acquired. In young children the opening of the prepuce is often narrowed so that it will barely admit a pin or probe. In such cases the lining of the prepuce is usually adherent to the glans and accretions of cast-off material are retained about the corona. These cause irritation with attacks of exacerbation and swelling of the prepuce. The narrowing is sometimes sufficient to obstruct the flow of urine, and the consequent straining is undoubtedly a factor in the production of hernia and hydrocele. Besides the more manifest direct results of this condition others more remote have been assigned to it. Tardiness in learning to walk, from lack of development of the legs or from want of power of coördination and various nervous disturbances, even to epilepsy, or in adults paranoia and insanity, have been associated with it. That it has been the source of a great deal of annoyance and has, in some instances, caused as much trouble as has been alleged is probably true, but there are many men with phimosis who are vigorous fathers of families and have never been suspected of reflex neuroses. There are men who do not know but what it is the normal state, and others who having been circumcised think they have been mutilated.

Fig. 673.
Fisher's
Phimosis
Forceps.



Fig. 674.
Ricord's
Phimosis
Forceps.

Acquired phimosis may be permanent or temporary. The permanent form results from cicatricial contraction following ulceration or injury, the temporary from swelling of the prepuce. Phimosis increases the liability to contract venereal diseases and complicates them very much. Chancroidal sores with their discharges shut up within such a prepuce are most disadvantageously placed.

TREATMENT. Circumcision is the remedy for all cases of permanent phimosis and for many temporary ones. Dilatation, in children whose parents will not consent to circumcision, can be made with a uterine dilator, but it will not do away with redundancy of tissue and is apt to be followed by recurrence. Redundancy of foreskin is nearly as strong an indication for circumcision as phimosis. The lining of the prepuce and the covering of the glans are skin, not mucous membrane, and are irritated by being continually moist, as is the case when the prepuce is too long. (Figs. 675 and 676.)

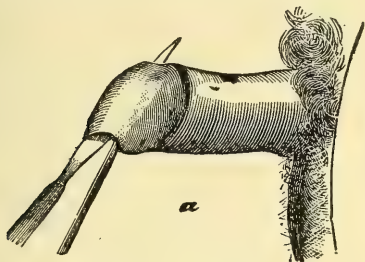


Fig. 675. Phimosis.

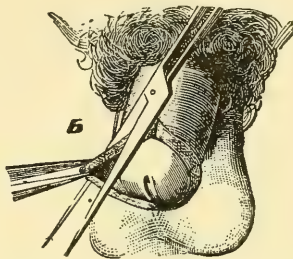


Fig. 676. Circumcision.

Circumcision may be performed in different ways, according to the form of trouble requiring it. When the prepuce is contracted but not redundant longitudinal incision in the median line back to the corona is all that is necessary. The angular margin left becomes straight, and in some cases retraction occurs till little prepuce remains. When there is redundant tissue it should be trimmed off with scissors, leaving in adults about one-third of an inch of the reflected lining of the prepuce, in children less. Because of the retraction of the penis in children and the inability to do much with them while the part is healing it is necessary to carry the initial incision clear back to the reflection of the preputial lining to prevent recurrence of phimosis from cicatricial contraction.

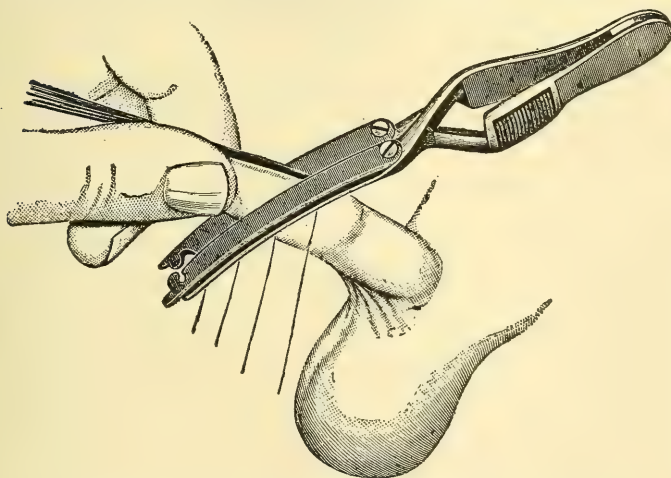


Fig. 677. Circumcision. Clamp and Stitches in Place.

Sutures of silk, horsehair, or sheep-gut should be employed in adults; in children the author uses none.

Vidal and others have employed forceps with long blades, slotted or with hinged guards, to clasp the prepuce, strongly pulled upon, in front of the glans.

Fig. 677. Long sutures were passed through the slots and both layers of the prepuce, after which the prepuce was cut off along the outer side of the blades of the

forceps. Then the forceps were removed, the sutures pulled up in the middle, divided and tried. Theoretically the method is attractive, but it is applicable only to cases where there is no inflammatory thickening; it takes a good while for its performance and is apt to leave the prepuce too long.

In acute inflammation of the part circumcision is to be undertaken with more caution. Some cases of balanitis, posthitis and chancroid make it imperative, but the cutting should usually be limited to the dorsal incision. Complete circumcision can be done after subsidence of the inflammation, if necessary.

ANESTHESIA. The author secures anesthesia as follows: In adults where there is no inflammatory infiltration of tissue, by cocaine; in adults where there is inflammation of the parts to be cut through, and in children above a few weeks old, by chloroform. In using cocaine about two drachms of a half per cent. solution are thrown into the connective tissue of the prepuce, so as to distend and give it an edematous appearance where it is desired to cut. The penis is previously constricted with a piece of sterilized roller bandage, and incision is made immediately after injection, so that the solution is allowed to escape before much can be absorbed. The cold water of the solution probably has something to do with producing the very satisfactory anesthesia. In young infants the operation is sometimes performed without anesthesia, but chloroform is usually employed.

Paraphimosis. — **Phimosis** pulled back over the glans penis is termed paraphimosis. Rapid swelling follows its occurrence, and if not relieved gangrene ensues. When seen soon after its occurrence the glans penis may be reduced by compression, the pressure being continued for a few moments. When this cannot be done incision of the constricting band with a curved bistoury will relieve the difficulty. Fig. 678. Circum-

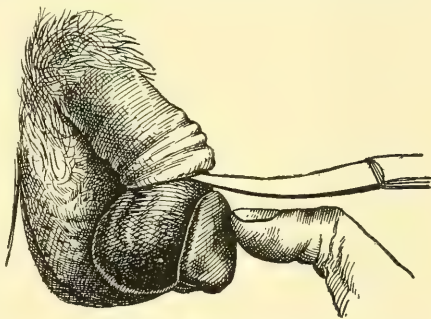


Fig. 678. Paraphimosis.

cision is the curative procedure.

CHAPTER II.

THE URETHRA.

Anatomy.—The male urethra is a sort of long sphincter, whose diameter, as compared to its length, is so small as to make any morbid alteration of it a serious mechanical impediment to a most important function, the voidance of urine, any considerable defect also causing organic impotence. It is about eight inches long, and is divisible into three portions, the prostatic, the membranous and the spongy, with a subdivision of the last, the glandular.

The prostatic portion is about one and one-fourth inches in length, is the widest and most dilatable, and is wider in the middle than at the extremities. It passes through the prostate gland from base to apex nearer its upper surface. It has projecting from its floor a longitudinal ridge, the *veru montanum*, with a depression, the *sinus*, on either side, so that on transverse section the channel presents a horseshoe form. Into the floor of each sinus open numerous prostatic ducts. At the fore part of the *veru montanum* is a depression, the mouth of the *sinus pocularis*, within or upon the edges of which open the slit-like orifices of the ejaculatory ducts. The *sinus pocularis*, or *uterus masculinus*, is a pouch extending upward about one-fourth of an inch beneath the *veru montanum*, and having numerous follicles opening into it.

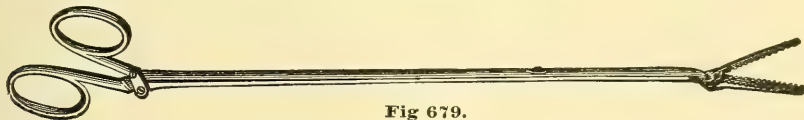


Fig 679.
Alligator Urethral Forcep.

The membranous portion extends from the prostate to the bulb and measures three-fourths of an inch on its upper surface and one-half inch below. Next to the meatus it is the narrowest and least distensible portion. It is invested by prolongations from both layers of the perineal fascia and by the compressor urethræ muscle.

The spongy portion is about six inches long, and extends from the membranous portion to the meatus. It is of uniform calibre, except for dilatations at the bulb and fossa navicularis. Within the glans it is dilated and flattened from side to side, forming the fossa navicularis at the expense of tissue above. A large follicle in the roof about one inch back, the *lacuna magna*, about one-fifth inch in depth, opens toward the meatus.

According to Otis the diameter of the urethra has a fixed relation to that of the penis. In the average adult its diameter is from twenty-four to twenty-seven French, with two points of little dilatability, the meatus and the triangular ligament, and three of great dilatability, the fossa navicularis, the bulb and the prostatic portion.

OTIS' SCALE OF URETHRAL MEASUREMENTS.

Circumference Midway of the Penis.

PENIS.				URETHRA.			
2	inches, or	-	75 mm.	30	-	-	mm., or more.
$3\frac{1}{4}$	"	"	81 "	32	-	-	" " "
$3\frac{1}{2}$	"	"	87 "	34	-	-	" " "
$3\frac{3}{4}$	"	"	93 "	36	-	-	" " "
4	"	"	100 "	38	-	-	" " "
$4\frac{1}{4}$ to $4\frac{1}{2}$	"	105 to 112	"	40	-	-	" " "

The mucous membrane is covered with columnar epithelium, except at the margin of the meatus, and there open upon it, especially in the spongy portion, the numerous racemose glands and follicles of Littre. In the floor of the bulbar portion are the openings of the ducts of Cowper's glands. The ducts of all these glands and follicles are directed forward so that the end of a catheter may be caught in them.

The sub-mucous tissue is composed of longitudinal and circular muscular fibres, fibrous and elastic tissue. The longitudinal muscular fibres are internal to the circular. The development of circular fibres varies in different parts, the greatest being in the upper part of the prostatic portion and the next greatest in the lower border of the prostate. The compressor urethræ muscle invests the whole of the membranous portion. The junction of the bulb with the membranous portion marks the boundary between the anterior and posterior urethra. This boundary is of practical importance, because the usually relaxed condition of the bulb allows its floor to be depressed two or three lines below that beyond, so that a catheter the beak of which is not kept hugging the roof may catch in the obstruction; and further, because of irritable spasm of the compressor urethræ muscle, fluids injected beyond this point in the treatment of disease may pass on into the bladder.

Malformations of the Urethra.—**ABSENCE.** Some urine is excreted during intra-uterine life and if it has no avenue of escape from the bladder the fetus rarely survives the eighth month. In a few cases children have lived after birth; the urachus has reopened, a vesicorectal fistula formed, or, the child being born with a greatly distended bladder, an artificial outlet has been made.

ATRESIA. Congenital atresia may exist at the meatus, within the glans, or within the deep urethra. It causes retention of urine that sometimes finds vent through the urachus or through a fistulous opening. Children with atresia are more apt to survive till birth than those with absence of the urethra.

Atresia at the meatus is caused by extension of mucous membrane over it. In a new born child that does not pass water, and indicates that it is distressed, this condition is ascertained by observing the absence of the meatus and the presence of a distended urethra and bladder. Cases of fistulous openings in the glans or floor of the urethra indicate that spontaneous rupture sometimes occurs before birth or subsequently. The

author has seen as many as three fistulous openings in the glans, none of which were where the meatus ought to be.

Treatment. This consists of puncture and the formation of a sufficient opening.

Atresia of the glandular urethra may coexist with that of the meatus, but usually the meatus is open. The location of the closure is to be found with a probe and the extent of it determined by observing how far the urethra is distended with urine.

Atresia of the deep urethra may occur in any portion, but has been most frequent in the anterior. A majority of the cases noted have died in utero, supposably from this cause. The existence and location of the trouble are ascertained as in the previous form.

Treatment is by puncture with a trocar in the urethra, and subsequent dilatation, if possible; otherwise by perineal section. After perineal section it may be possible to open the urethra by working from both ends when it cannot be done from the front only.

CONGENITAL STRICTURE. Narrowing of the meatus is nearly as frequent as phimosis and frequently coexists with it. It obstructs the flow of urine, according to its degree, excites local irritation and various reflex disturbances. Impotency may be one of the results.

Treatment. This is by incision. When the abnormality is a dam-like extension of the floor too far upward it may be snipped with scissors; but care should be taken not to overdo the matter, as destruction of the floor of the fossa navicularis sometimes impairs the power of erection. If the narrowing is within the meatus incision is best made with a bistoury used through a speculum. The speculum or a sound should be introduced often enough to prevent subsequent adhesion of the divided tissue.

Stricture of the deep urethra is not usually discovered till adult age, and as there is no positive method of distinguishing the congenital from the acquired there is some uncertainty concerning the frequency of the former. A valve-like remnant of the pre-natal septum between the glandular and penile portions of the urethra has been found to persist and cause narrowing; valve-like folds of mucous membrane have also been demonstrated post-mortem in the prostatic urethra. Other narrowings, particularly in the penile portion, are probably congenital; but the evidence, in a given case, is not conclusive. From a practical standpoint the distinction is of little significance. The treatment will be considered under the head of acquired stricture.

CONGENITAL DIVERTICULA OF THE URETHRA. A few cases have been noted. They consist of dilatation of the penile urethra behind the glandular portion, due to obstruction of urine by valve-like folds of mucous membrane at the glandulo-penile junction. They have been successfully treated by removing the redundant tissue, both skin and mucous membrane, securing unobstructed outlet through the meatus and uniting the lateral margins of the wound over a catheter.

Hypospadias.—Hypospadias is a congenital absence of a portion of the floor of the urethra. It may exist in any degree from that affecting only the portion within the glans to that extending back to the scrotal junction, or, the scrotum being divided, to the perineum. Cases have been classified according to the location of the point where the urine is

discharged as glandular or balanitic, penile and perineal. The deformity has been attributed to arrest of development, but the theory has been advanced that it may result from ante-natal rupture of an imperforate urethra (Kaufmann). The presence of cicatricial tissue about the displaced urinary opening and the contracted condition of the under side of the penis lend some probability to the supposition. The defective penis does not grow as it ought, but continues small, with a downward curvature most noticeable during erection. When the opening is far back the penis is sometimes adherent to the scrotum and is sometimes twisted. The orifice at which the urine escapes is often contracted so as to interfere with the flow of urine. In children it may be dilated, but usually re-contracts. In older persons, where the deformity is too great to justify effort toward more extensive repair, permanent patulency of the opening may be secured by removing a small circle of skin around it, splitting the mucous membrane longitudinally, pulling it out and stitching its margin to that of the skin (Bokar). According to the method of Kaufmann the mucous membrane is split longitudinally and a wedge-shaped piece of neighboring skin is stitched into the fissure. If the defect extends far back it causes organic impotence. It is mainly for the relief of this that operations for repair are performed. The method of Duplay has been the one commonly followed. It usually consists of three operations performed at different times.

The first operation is to remedy the curvature (Fig. 680, a), but is

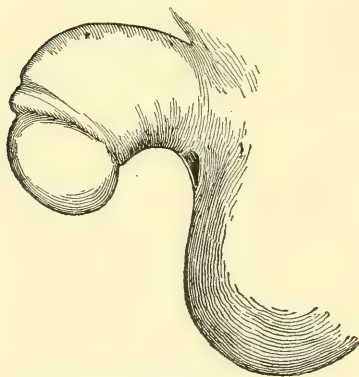


Fig. 680, a.
Duplay's Method of Straightening
the Penis in Hypospadias.

not necessary if the curvature does not exist in a marked degree. It is done by making, on the under side of the penis, one or more transverse incisions, deep enough to divide all contracted bands and allow the organ to be straightened, after which the lateral margins of the diamond-shaped wound (Fig. 680, b) are stitched together, (Fig. 680, c) and small splints retained with adhesive plaster till healed. Any open fissure lined with mucous membrane is to be carefully preserved

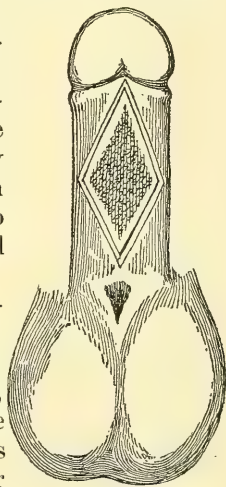


Fig. 680, b.

during this stage of the procedure.

Some months after the first operation the construction of a urethral canal through to the end of the penis is to be undertaken (Fig. 681, a and b). It is done by freshening or splitting the edges of the fissure, where one exists, and uniting them around a suitable piece of catheter by a quilled suture. When no fissure is present parallel longitudinal incisions are made, far enough apart to allow for a little more than half the circumference of a urethral lining to be made from the skin. The skin is slightly dissected inward from the incisions and freely outward, and the outer flaps united by a quill suture as in case of fissure. The canal thus

made contains a strip of skin, forming more than half its circumference, and which by its elasticity prevents cicatricial closure. If the glans does not present a well marked groove on its under side it is perforated by a trocar and a piece of catheter retained till a permanent fistula is formed. Unfortunately, there is a tendency toward subsequent contraction. The quilled sutures are formed by single silver wires or silk-worm sutures passed through perforated lead strips and fastened with shot.

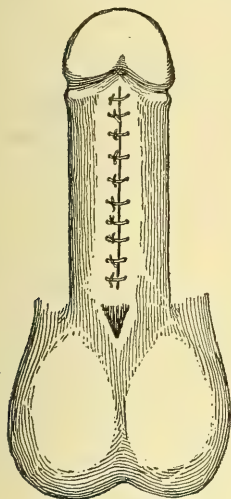


Fig. 680, c.

During the whole process of urethra building the urine is allowed to escape at the original opening through a gap left for the purpose. This part of the method has been varied by making a perineal opening, so that no urine can come near the site of reparative work, and the whole canal can be closed at once. The perineal opening is allowed to close after it is no longer needed. (Bangs).

After sufficient time has elapsed to make sure that the second operation has been a success closure of the hypospadiac fistula may be undertaken, unless it has already been done, by the employment of a perineal opening at the time of the second operation. It is done by freshening the edges for one-half inch around and uniting them by a quilled suture, as in the second stage. A catheter is retained for some days.

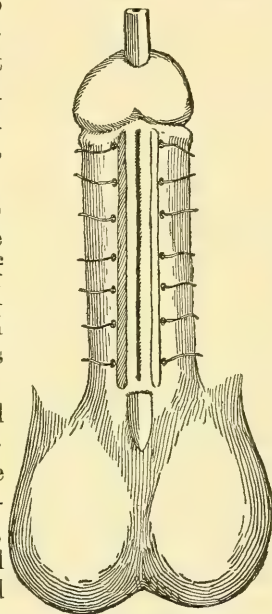


Fig. 681, a.

Duplay's Method of Forming the Penile Urethra.

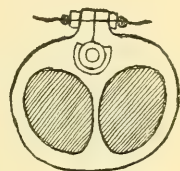


Fig. 681, b.

As regards the age at which the operations are advisable: That the organ may have a better opportunity to grow it is thought best to do the first early—at about the fourth year, the second a year later, and the third after puberty. In an adult the whole has been done in a year's time. This, like some other operations of constructive surgery, presents abundant opportunities for failure.

Epispadias.—Epispadias is a congenital deficiency of some portion of the upper wall of the urethra. It may exist in any degree; the urine sometimes escapes from just behind the glans, sometimes from the penis in front of the symphysis, and sometimes from a fissure in the bladder. Epispadias is much less common than hypospadias, and, unlike it, is most frequent in extreme degrees—in connection with extrophy of the bladder. The glandular form is very rare, only a few cases having been recorded. Cases of the penile form are a little more numerous, but still rare. The

principal methods for its repair have been those of Duplay, Kronlein and Thiersch.

Duplay's method is essentially the same as that described under hypospadias, except that the redundant prepuce, usually present below the glans, is button-holed, pulled over the glans, and stitched to the vivified dorsum of the penis, so as to join the newly formed penile and glandular portions of the urethra.

Kronlein modified Duplay's method by combining the middle and last operations.

Thiersch's method consists of five stages:

First. The formation of a perineo-vesical opening to divert the urine from the field of proposed operation (Fig. 682, a.)

Second. The construction of a passage through the glans is secured by making two parallel longitudinal incisions two-thirds through it and converging, so as to leave a wedge-shaped piece between. A narrow strip external to each incision is then freshened and the two lateral flaps brought over the central strip and stitched. The epithelial strip on the depressed wedge insures a channel. (Fig. 682, b.)

Third. To form the penile section of the urethra, two long, rectangular flaps are made on the dorsum of the penis, extending from the glans to the urinary orifice. The flaps, both looking in the same direction, are dissected up freely, one is turned back upon

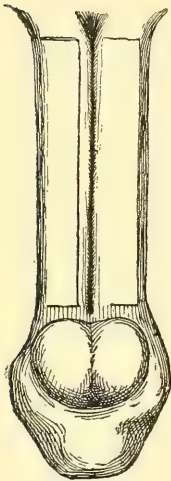


Fig. 682, b.

itself and over the urethral groove, so as to bring the raw surface outward, and stitched to the margin of the other incision, the sutures not being tied, but passed on through the base of the other flap as it is pulled up over the first. The raw surfaces of the two flaps come together and the margin of the super-imposed one is stitched to the edge of skin beyond where the first one was taken from. The urethral canal formed has a complete

epithelial lining from the first flap turned down, and no catheter is needed to keep it open. (Fig. 682, c.)

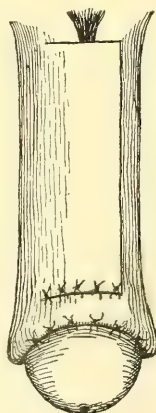


Fig. 682, d.

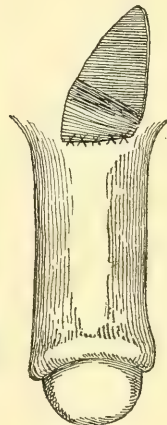


Fig. 682, e.

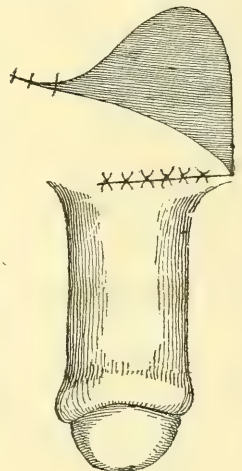


Fig. 682, f.

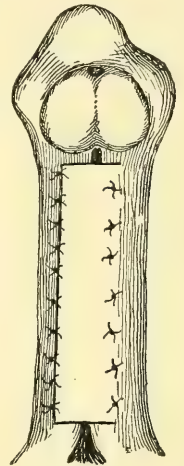


Fig. 682, c.

Fourth. Connection between the penile urethra and the glandular, previously formed, is made by button-holing the prepuce below the glans, putting the glans through it and stitching its edges to the margins of each. (Fig. 682, d.)

Fifth. Closure of the funnel-shaped opening at the point where the urine has escaped is accomplished by means of two flaps taken from the abdomen. A triangular flap is taken from one side so as to cover the opening, skin inward, and stitched to the freshened margins. A second, larger, triangular flap is brought down from the other side and stitched over the first, skin outward. The denuded surface on the abdomen is left to heal by granulation. (Fig. 682, e, and Fig. 682, f.)

The perineal fistula usually closes spontaneously when it is allowed to.

According to Thiersch's estimate it requires about fourteen days to establish the perineal fistula; fourteen for closure of the glandular groove; twenty-one for union of the penile flaps; fourteen for the transplantation of the foreskin; forty-two for the closure of the funnel and subsequent operations—altogether about four months.

Lösse's modification, applicable to cases where there is not skin enough on the penis to make the flaps employed in Thiersch's method, consists in utilizing flaps taken from the scrotum. Scrotal tissue is also used in closing the funnel.

Hermaphroditism.—True hermaphroditism, in which a testicle is present on one side and an ovary on the other is very rare—if it ever

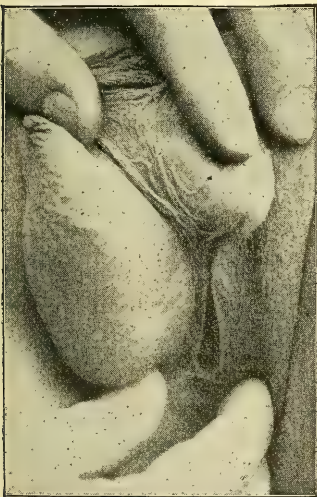


Fig. 683.
Hermaphroditism Vagina.

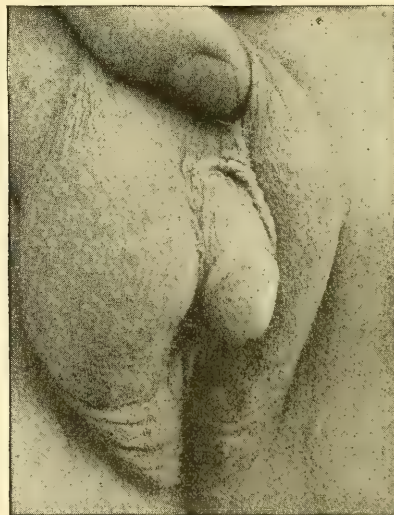


Fig. 684.
Hermaphrodite
Male Organs. Testicle in Labia
Majora.—Martin.

exists. Perineal hypospadias is the condition of the male sex which by cleft scrotum and rudimentary penis suggests hermaphroditism; it is one of the forms of pseudo-hermaphroditism.

The only treatment that can be given is to enlarge the urethral orifice when contracted. The method is described under epispadias.

CHAPTER III. URETHRITIS.

Gonorrhea.—Gonorrhea, or infectious urethritis, is very common and very prolific in sequelæ that come within the surgical field. It is supposed to be due to gonococci, a special form of diplococci. Lodged within the meatus they multiply, permeate the epithelial cells, penetrate as far as the underlying lymph spaces and connective tissue, and by their presence irritate the tissues and cause inflammation. The profuse purulent discharge contains large numbers of leucocytes that serve to absorb and carry off great numbers of the intruding organisms, and rapid exfoliation of epithelium serves the same purpose. Excessive exfoliation may cause erosions or ulceration. The acute inflammatory attack is an attempt of nature to eliminate the invaders. As their numbers diminish the gonorrhea subsides.

Such is the prevalent opinion in the matter, but the discovery in the epithelium of normal urethræ of diplococci that cannot be distinguished microscopically from those present in gonorrhea has made diagnosis by the microscope less positive. Large numbers of gonococci in copious discharge are considered indicative of infectious character; but clinical observation has shown that scattering diplococci in a scant, gleetty discharge are not necessarily so. It might appear that instead of gonococci being proof of gonorrhea the existence of gonorrhea is necessary to establish the identity of the gonococci.

Whatever the agency of gonococci may be it is pretty certain that the local and general conditions of persons affected greatly influence the course of the disease. A long prepuce, a narrow meatus, a mucous membrane weakened and irritable from sexual excess, and scrofulous or debilitated general state furnish conditions for the more severe and lasting forms of the disease.

The usual period of development is from three or four days to a week, but two weeks have been known to pass. In some instances exposures have been so numerous that it is impossible to fix a date of infection.

SYMPTOMS. Itching and swelling of the meatus, burning on urination, appearance of discharge—at first mucous, afterward muco-purulent—and feverishness develop in order. When the disease is at its height the pain on urination may be very intense, and very painful erections at night are frequent. Infiltration of the corpus spongiosum gives the organ during erection a curved form known as *chordee*. Swelling of the prepuce and temporary *phimosis* are common; less so are swelling of the whole penis and affection of the inguinal glands. When the prepuce is long or *phimosed* irritation and perhaps inflammation of the opposed surfaces of the glans and prepuce occur.

The course and duration of the disease are much influenced by the habits of the person affected and the treatment he receives, as well as by

his individual susceptibility. If he attempts to continue about his business, continues to use tobacco and spirituous liquors, eats stimulating food, and allows his bowels to remain constipated, his case is likely to continue indefinitely in spite of any treatment.

TREATMENT. A host of remedies for local and internal use have been employed, yet surgeons are busy in the treatment of gleet, stricture and other sequelæ of the disease.

The author's ideas and plan of treatment are as follows: The deleterious effects of the hydrostatic pressure of the blood in all inflammations in the neighborhood of the pelvis, when the body is in the erect position, make rest in bed as beneficial and essential in this affection as in metritis or other acute pelvic inflammation. That most patients wish to go about their business and keep their friends from knowing their condition makes it difficult to secure this coöperation in many instances; but, in view of all the possible future consequences of the disease, this most important advantage in the treatment should not be neglected. With rest and freedom from mechanical irritation secured, total abstinence from tobacco, liquors and stimulating articles of food is insisted on, and the rectum is kept empty by enemata. To still further diminish irritation the patient is urged to drink large quantities of water, with a view of diluting his urine; if that is highly acid, liquor potassæ or other alkali is added to some of the water drunk to lessen the acidity. With these conditions supplied early the inflammation does not become so severe, is less apt to be attended by complications, and subsides much sooner.

During the first week aconite, or gelsemium, and cannabis sativa are given. The penis is frequently bathed in hot water, and after a few days peroxide of hydrogen or a pink solution of permanganate of potash is injected three times daily. Sometimes a small soft catheter is introduced into the bulbar portions and very hot irrigations kept up for a half hour daily. Bichloride solution, 1:10,000, or permanganate of potash, 1:5,000, are employed. When pain during urination is great cocaine solution is previously injected. By restraining the inflammation as much as possible, and by avoiding caustic injections, the liability to erosion and ulceration of the mucous membrane is reduced. It is about these comparatively small foci that chronic inflammation persists and chronic discharge forms. (For homeopathic medication see page 1077.)

Non-Infectious Urethritis.—Inflammation of the urethra, with muco-purulent discharge may occur from other causes than gonorrheal infection. Traumatism from external violence or from calculi within the urethra; herpes of the mucous membrane; contact with menstrual blood or leucorrhæal flow, and sexual excess are causes. Traumatic urethritis usually subsides quickly, and that from menstrual blood is much less persistent than gonorrhea.

The treatment varies with the cause. Rest and the administration of aconite are appropriate in the traumatic form. If due to herpes or syphilis, primary or secondary, suitable medical treatment is needed. If there is a calculus in the urethra it should be removed with a scoop or otherwise. Urethritis acquired from sexual connection with women supposedly free from gonorrhea should be treated on the same general principles as are laid down for that disease.

Complications of Gonorrhea.—**POSTERIOR URETHRITIS.** Extension of inflammation beyond the compressor urethræ muscle is indicated by pain in the perineum, increased frequency of urination and tenesmus. It usually does not develop till after the second week, is comparatively infrequent, and commonly transitory. Long lasting cases, resulting in stricture, do occur however. With rest and careful treatment from the beginning of an attack of gonorrhea this extension is less liable to follow. If rest has not been insisted upon before it certainly should be after this complication has developed. The drinking of large quantities of water, by diluting the urine and making it more bland, and by its increased cleansing power, has a beneficial effect. Injections of more than a few drops of fluid into this part of the urethra enter the bladder. Five to ten minims of sulphate of zinc solution, five grains to the ounce, or silver nitrate solution, three to five grains to the ounce, may be injected two or three times a week. A special catheter with syringe attachment has been devised by Ultzmann, but the point of deposition can be definitely located by a soft catheter with a stiff wire of proper curvature in it, and injection made through it. Cantharis and turpentine are prominent among the remedies that may be given internally.

FOLLICULITIS. Inflammation of the glands and follicles of Littre is more apt to occur in the neighborhood of the fossa navicularis or the bulb. A globular swelling and tenderness exist at the affected point and the inflamed follicle may continue to exude pus into the urethra indefinitely, or the duct may become obstructed and a cyst as large as a pea may form. This may continue for a long time in an indolent form and finally be absorbed, or it may rupture into the urethra or externally. It may be caused to disappear by evacuating its contents and injecting a drop or two of carbolic acid.

COWPERITIS. Inflammation of one or both of Cowper's glands rarely occurs. When it does develop it is not till gonorrhea has existed for some time. It causes pain on sitting and a nodular, tender swelling of about the size of a filbert in the perineum. It may cause retention of urine from pressure upon the urethra. Suppuration may occur, manifested by the usual signs, and rupture may follow into the urethra or externally.

Treatment is rest with moist compresses; if suppuration ensues, incision, and antiseptic dressing.

PROSTATITIS. This is infrequent and not apt to develop till after the third week; but when it does develop it is a serious complication. It may be of follicular or diffuse form.

In the follicular variety one or more follicles are affected, causing pain, frequent desire to urinate and tenesmus. The pain and spasm are greater than in posterior urethritis, and rectal examination reveals nodular swelling and tenderness.

In the diffuse form much greater swelling of the gland occurs and general fever is marked. In addition to the pain and tenesmus a sense of fullness and weight is felt by the patient and rectal examination discloses a large, tender, hot tumor that may impinge on the rectum till only ribbon-like stools can be voided. The majority of cases terminate by resolution in a few days, but suppuration sometimes ensues. Its onset is marked by a chill, followed by increased fever and perspiration. The abscess

more often breaks into the urethra, sometimes into the rectum and sometimes through the perineum. In rare instances rupture into both urethra and rectum takes place and results in permanent fistula. The author has encountered one such case and secured closure of the fistula.

Treatment should be rest, hot sitz baths, hot enemata, hot fomentations to the perineum, and aconite, belladonna, cantharis or hepar sulphur internally. If fluctuation is recognized by the examination through the rectum incision and drainage should be made through the perineum.

VESICULITIS. The seminal vesicles and their ducts are sometimes invaded by the gonorrheal inflammation. The subjective symptoms resemble those of posterior urethritis, which usually accompanies, with the addition of inordinate sexual desire and frequent pollutions—a sort of vesicular tenesmus. The fluid evacuated is yellow or brownish and contains pus, blood, and dead spermatozoa. Digital examination through the rectum reveals the swollen, tender vesicle extending upward above the prostate. The inflammation usually subsides in a few days, but sometimes becomes chronic, in a milder form. In chronic cases sexual neurasthenia, with symptoms of posterior urethritis, is present. In addition to what can be learned by palpation the vesicular contents may be expressed and secured for examination in the following way: A little urine is passed in one vessel to wash the urethra; the vesicular contents are expressed by the finger, a little more urine passed in a second vessel to float out the expressed fluid; and, finally, urination completed. Examination of the three specimens shows the character of the secretions of the urethra, seminal vesicles, and bladder respectively.

Treatment. In acute cases, rest, hot sitz-baths, hot enemata, with aconite, gelsemium, digitalis, or mono-bromide of camphor.

In chronic cases systematic expression of contents two or three times a week seems to have an effect like drainage upon an abscess. It evacuates irritating accumulations, and by gentle massage seems to afford a stimulation needed in some cases. Medical treatment is to be given on general indications, and good hygienic and dietetic habits observed.

CYSTITIS. Cystitis from gonorrhea is less frequent than is supposed, posterior urethritis being sometimes mistaken for it. Its symptoms and treatment are given in another place.

PHIMOSIS. The phimosis that sometimes results from swelling of the prepuce is largely preventable, and if present is palliated by the rest and hot bathing described in the treatment of gonorrhea. Circumcision is not advisable at a time when the wound must be bathed with the the gonorrheal discharge.

EPIDIDYMITIS. Epididymitis compels rest; rest taken beforehand many times prevents the epididymitis. When present artificial support, by strapping with adhesive plaster or covering with collodion and cotton, affords relief. Greater relief is sometimes given by hot compresses packed around the swollen testicle and covered with rubber tissue.



Fig. 685.
Phimosis with Gonorrhea.

Pulsatilla, belladonna and gelsemium hasten the resolution that usually occurs in a few days.

GLEET. Chronic gonorrhea, or gleet, is a remnant of an acute gonorrheal attack which never fully subsided. The term is applied to cases that have lasted longer than about eight weeks. There are numerous reasons for its continuance. Constitutional aberration is doubtless an important cause for persistence of the complaint. An impaired vitality lacks the power to eradicate the micro-organisms. Previous irregularities in the contour of the urethra are exaggerated by inflammation and new elevated patches of inflamed mucous membrane form, to become subject to mechanical irritation from flow of urine. Erosions, granulating patches, and ulcers, that developed in the acute attack, may be the foci about which inflammation lingers. A discharge, muco-purulent, mucous, or consisting of white shreds that are washed out by urine, persists.

The question of the communicability of the disease, in a given case, is an important one, as it is now believed that much of the metritis, salpingitis, etc., with which women suffer, is due to gonorrhea, often innocently acquired from husbands having gleet. An easy test of the white shreds, or Tripper-faden, is to observe whether they sink or float in water. If they float they probably consist largely of epithelium, and are not likely to transmit disease; if they sink they contain pus and are dangerous. From microscopic examination the proportion of pus can be ascertained, and some idea of the number of gonococci. If they are plentiful transmissibility of disease is probable; if scattering or absent it is improbable.

The treatment of gleet should begin with a careful examination of the urethra with bulbous bougies, Fig. 686. By this means the location and extent of the thickened, inflamed spots can be ascertained. One or more will be found; and, if there is no acute inflammation present a steel sound the size of the urethra should be introduced. The urethra may first be anesthetized by inserting through a urethroscopic tube a strip of cotton cloth or candlewick saturated with a four per cent. solution of cocaine, to be pulled out when sufficient effect has been produced. No definite time for reintroduction of the sound can be prescribed, for there is a great difference in the reactionary effects following its use. In one case very little inflammation follows, and the sound may be used as often as every other day; in another, where no greater violence has been done, it is out of the question to repeat it for a week or ten days. After the sound has been used a few times it should be discontinued to see what the condition is after the irritation caused by it has subsided. In the meantime astringent injections may be employed. Soluble medicated bougies are liked by some; but, except when waiting for the irritation caused by the use of a sound to subside, the author prefers a strip of gauze saturated with the chosen solution and inserted through an endoscopic tube, or powders introduced in the same way. By

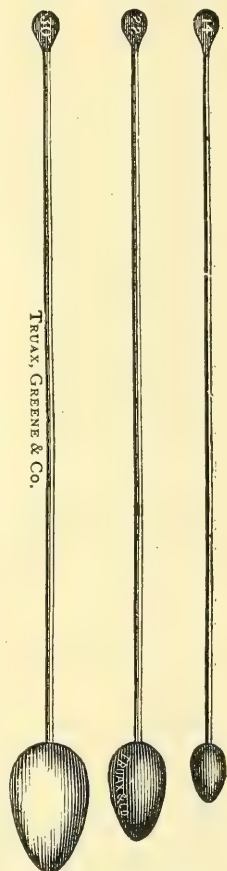


Fig. 686.
Otis Bougies.

either of these methods prolonged action of medicines is obtained at the same time that mechanical pressure is being used. Of course care must be taken not to use in this way any drug capable of destructive effect. Hydrastis, fl. ext., 30 drops to the ounce, and zinc sulphate, 25 grains to the ounce, are solutions most used, and the powders are hydrastis, muriate of hydrastin 1x, aristol, and carbonate of lead 1x. The packing is retained for fifteen minutes to a half hour, and the powders till washed away by the urine.

With sunlight or other powerful light thrown into the tube by a head mirror, or by a special electric illuminator, it is possible to inspect the urethra and apply treatment directly to affected points. Fortunately the greater number of inflamed spots are in the anterior urethra; but to a skilled observer it is possible to inspect the prostatic urethra. The shorter and wider the tube admissible in a given case the more satisfactory is its use. Tubes from 23 to 32 French, and from three to five and a half inches long, give satisfactory results. If the meatus is not large enough for their use, it should be made so. For the portion of the urethra within two inches of the meatus a dilating speculum is preferable to a tube. Every chronic affection within the anterior urethra ought to be looked at, as well as felt of with bulbous bougies.

Compression of the swollen tissue by steel sounds restores temporarily the calibre of the urethra and lessens the obstructive irritation, while the astringents help reduce inflammation and restore tone to the membrane.

When the posterior urethra is affected injections are sometimes thrown beyond the compressor urethræ muscle, with a view of letting them enter the bladder after passing over the urethral mucous membrane. Care must be taken to use only fluids that are likely to be tolerated and to use them when there is some urine in the bladder, so that further dilution will occur there. A better plan is to have the urine passed just before treatment and then inject into the bladder a definite quantity of water before using the medicated solution—the bladder to be emptied immediately afterward in the natural manner. Ultzmann used zinc sulphate, alum and carbolic acid, aa, 1 part to 1,500, afterward reduced to 500 parts; later, permanganate of potash, 1 to 2,000 and 1 to 1,000; then nitrate of silver, 1 to 2,000, gradually carried up to 1 to 1,000. Fluid ext. hydrastis in about the second dilution is a good agent for the purpose. A few drops of stronger solutions of zinc sulphate or silver nitrate may be injected into the posterior urethra, or medicated suppositories of cocoa butter may be pushed through a catheter, open at the end but closed by an obturator during introduction.

Constitutional treatment given upon the totality of symptoms and proper habits helps the recovery.

Further consideration of the treatment will be given under Stricture.

Gonorrhea—Homeopathic Medication.—Aconite is especially useful in the painful stage, when there are smarting and burning upon urinating, heat of the penis, headache, fever and allied symptoms.

Belladonna is occasionally needed in congestion of the organ, with painful priapism. Erections are painful and long continued. The penis

is gorged with dark blood, is hot and aches and throbs because of the congestion and commencing inflammation.

Cannabis sativa is especially applicable in the commencement when the discharge is thin and watery. There is smarting and burning after urinating, and walking is painful. The prepuce is swollen and tender, and the urethra feels as if drawn in knots.

Cannabis indica is particularly applicable to chordee, priapism and sexual excitement. Urging to urinate, but urine voided with difficulty and pain. Sleepless nights, because of chordee and sexual erethism. (Monobromide of camphor.)

Pulsatilla is an excellent remedy for orchitis and suppressed gonorrhea, as also for gonorrheal rheumatism. Discharge green, thick, mucopurulent, or of deep yellow color.

Copaiva will be found useful when the discharge is milky or yellow and corrosive. The urine has the odor of violets; before and after voiding it the meatus itches and burns like fire.

Cantharis will be needed when there is severe strangury, with voiding of but a few drops of hot, even scalding, urine. Urine is bloody, scanty, and the tenesmus extreme.

Gelsemium will often be called for in the first stage when there is little if any discharge but severe pain and heat in the penis. Inflammatory orchitis from suppression of the discharge, with painful erections and general febrile disturbance. Gonorrheal rheumatism with general fever calls for *gelsemium*.

Thuja meets chronic cases in sycotic patients, and is also applicable in acute or sub-acute cases when there is a sensation as if a drop of urine or gonorrheal discharge remained behind the gland, causing itching and a feeling of discomfort. Sensation as if a band encircled the penis, preventing free urination. Suppressed gonorrhea resulting in rheumatism, orchitis, skin eruptions, conjunctivitis, headache and mental depression.

Sepia is a useful remedy in occasional cases that have not yielded to other apparently indicated remedies, in which the tendency is to chronicity with gleet, rheumatism, boils, etc. It meets the occipital headache of suppressed gonorrhea, and is also indicated in melancholia from this cause. Sexual imbecility with severe mental depression.

Nux vomica, *mercurius*, *hydrastis*, *kali bichromicum*, *petroselinum*, *sulphur*, *sarsaparilla*, *nitric acid*, *graphites*, *kali muriaticum* and other remedies will have to be studied in special cases.

CHAPTER IV.

ACQUIRED STRICTURE.

Definition.—The urethra becomes abnormally narrowed as a result of gonorrhea, traumatism, lithiasis, and new growths. Wounds of the urethra, especially transverse ones, inflicted from without or from within result in cicatricial stricture. The more frequent sources of injury to the anterior urethra are malicious cutting, gunshot wounds, and fracture of the penis; to the posterior, contusion or rupture from falling astride fences or like objects. Abrasions from catheters and prolonged irritation from urinary deposits, either urates or phosphates, are other sources. The most common cause, however, is gonorrhea.

The mucous membrane being surrounded by a contractile muscular layer that keeps the canal closed, except when temporarily distended from within, permeation of the mucous and submucous tissue by inflammatory exudate, by lessening elasticity, tends to prevent the normal dilatation during the passage of urine. Obstruction of the stream causes frictional irritation at the point of obstruction, with disposition to retention of a small amount of urine, tending to produce dilatation behind and adding to the irritation. Some pathologists hold that in addition to the original cause of the inflammation and the mechanical irritation the infiltration of the granular patch of mucous membrane, or of the ulcer, by urine is an important factor in the development of permanent cicatricial stricture. However it may be produced the abnormal development exists in all degrees, from a simple inflammatory thickening to a dense fibrous tissue of almost cartilaginous consistency, and the narrowing produced is equally variable in amount. When the obstruction becomes nearly complete dilatation and thinning of the urethral wall behind it may sometimes lead to rupture, extravasation of urine, sloughing, and the establishment of a fistulous opening through which the urine escapes. Any considerable obstruction to the passage of urine causes incomplete emptying of the bladder. The amount of residual urine depends on the degree of obstruction and the age of the person, increasing with age. The retained urine decomposes and excites cystitis. Continued distension of the bladder causes backward pressure through the ureters and results in hydro-nephrosis and perhaps pyelitis.

Diagnosis.—Subjective symptoms are frequent urinations, a twisted and irregular stream, and dribbling at the close of the act. A gleet discharge is pretty strong evidence of stricture, but stricture is often present when there is no perceptible discharge. When the obstruction is great, considerable pressure is required to expel the urine, and retention is sometimes experienced. Potency is often impaired by too early ejaculation.

Objective signs are distinguished by examination with bulbous bougies or the urethrometer of Otis. Otis taught the profession a great deal about the urethra, but the standard of size that he set up was that of

greatest distensibility, one considerably beyond the working standard required for proper functional use. His criticsers say that the urethrometer (Fig. 687) detects narrowings in the majority of healthy urethræ, and that he and his followers have cut many a congenital narrowing that never did any harm. He held that the pre-existing narrowings were the main reason for the persistence of the gonorrheal inflammation at those points. The bulbous bougies, in graduated sizes, are handier and better

for examination of the urethra than the urethrometer, which is only occasionally used by most practical men. With them the location, longitudinal extent and degree of stricture are readily made out, and by the combined senses of feeling and of sight, directed to the upper end of the bougie as it is pulled back and forth over the stricture, the side upon which it lies can be determined. The greater number occur in the anterior urethra, but some are found in the membranous portion. On account of the pouch-like dilatation in the bulbar portion and the liability to deception at the point where the urethra penetrates the fascia the bulbous bougies are not satisfactory for examination beyond the bulbo-membranous junction; steel sounds are better for the deep urethra.

Strictures are classified as spasmodic and organic. The latter are arbitrarily divided into those of small and large calibre, as they admit bulbs below or above the size of 15 Fr. They are further spoken of as soft or hard, according to consistence, and resilient, when after dilatation they show by immediate recurrence that they have only been stretched, not torn.

Spasmodic stricture causing retention usually occurs in the posterior urethra, but the spasm excited by examination sometimes gives an exaggerated appearance to narrowing in the anterior urethra. To lessen this source of error examination should be very slowly and deliberately done with instruments that have been warmed and well lubricated.

Treatment.—This varies with the form of the disease and the fancy of surgeons. Some would cut all, others but a few. Gradual dilatation and sudden rupture or divulsion are other methods.

In undertaking any case the writer is guided in part by local conditions, in part by the person's temperament and the length of time he can probably be kept under observation. In some nervous, hyper-sensitive persons the use of any instrument in the urethra is like putting fire to powder; and when something must be done no long-drawn-out method is apt to be satisfactory. Complete division by cutting is the shortest method.

Gradual dilatation by steel sounds is employed in soft strictures of large calibre and is performed as follows: With the patient in the recumbent position and the urethra cocaineized, a conical sound about two sizes larger than the bulb admitted in examination is slowly and carefully introduced, kept in about ten minutes and as carefully withdrawn. The act is repeated every two or three days, with progressive increase in the size of the sounds, till one of the full size of the urethra is admitted.

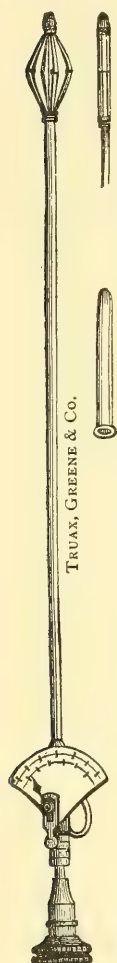


Fig. 687.
Otis Urethrometer.

Afterwards this sound is introduced at lengthening intervals and continued as often as once a month for a year. In many cases the tendency to recontraction is never overcome, and the use of the sound two or

three times a year is desirable. If a contracted meatus complicates the case it should be incised at the commencement, for the meatus is but slightly dilatable.

In some cases where cystitis or other complication compels quietude gradual dilatation may be secured by keeping a catheter tied in. Constant pressure causes absorption of stricture tissue, and, a larger catheter being used every three or



Fig. 688.
Penile Introduction of Sound.

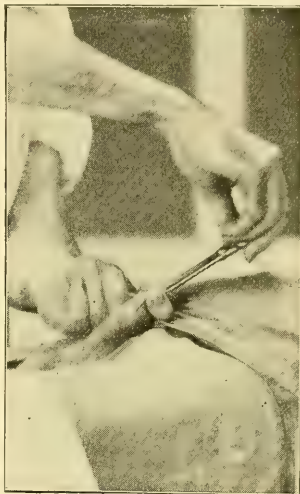


Fig. 689.
Abdominal Position for Spongy Portion of Penis.

four days, a good calibre can be restored without any violence whatever. The catheter may be retained for a couple of days before removal for cleansing, and sometimes for as many as five days where reintroduction is difficult and accumulation of mucus is not too great. The bladder may be washed out through it and the urine allowed to run away as fast as formed, or a stopper may be put in the catheter, to be removed as needed. The applicability of this method can be ascertained only by trial, some persons being so nervous that the catheter cannot be tolerated at all, while others wear it without inconvenience. The author has employed it continuously for as long as two months. A good soft rubber catheter is used and retained by strings tied to it and to a strip of adhesive plaster encircling the penis.

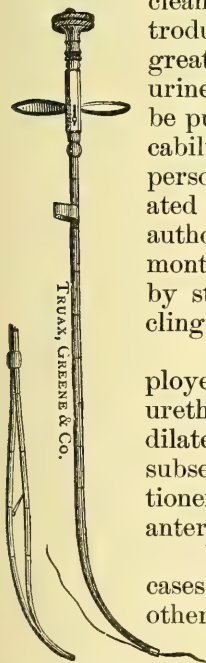


Fig. 690.
Gouley's Dilator.

DIVULSION. Divulsion with Gouley's instrument is employed by the author mainly in stricture of the posterior urethra. With chloroform narcosis the stricture is at once dilated till a full-sized sound passes freely. The sound is subsequently used to keep up dilatation. With some practitioners divulsion is the favorite procedure for stricture in the anterior urethra. (Fig. 690.)

URETHROTOMY. Opinions differ as to the frequency of cases requiring this operation. Some cut nearly all cases; others only exceptionally. The author thinks that internal urethrotomy is called for in the anterior urethra when strictures are of small calibre, are dense or of considerable longitudinal extent, or are resilient, and that external urethrotomy is indicated in small strictures of the posterior urethra or

when urinary fistula is present. The prevalent practice is to cut into the roof of the anterior urethra and into the floor of the posterior. Accord-



Fig. 691.
Engagement in Membranous and Prostatic Curve of Urethra.

ing to personal observation, the stricture tissue does not uniformly encircle the urethra, but develops more on one side, and it is thought preferable in the anterior urethra to cut on the side where the thickening is. With the Gross urethrotome (Fig. 694), having a bulb with a concealed knife at the end, it is possible to locate the stricture exactly and incise it and nothing else, after which it may be



Fig. 692.
Passing Prostate.

split throughout with the divulsing instrument.

The Otis dilating urethrotome may be used, but with a somewhat less definite adaptation of the incision to the stricture and a greater disposition to hemorrhage. Strictures within an inch and a half of the meatus may be cut under ocular inspection with a tenotome and meatoscope. After cutting by any method a full-sized sound should be introduced



Fig. 693.
Sounding Viscus.

without meeting any obstruction whatever, and should be subsequently used two or three times a week to prevent adhesion of the incision. If bleeding cannot be controlled by manual compression a tight bandage may be applied, with a sound in the urethra. Cocaine anesthesia is sufficient for internal urethrotomy in the anterior urethra, and it is best to repeat it before each subsequent use of the sound.

EXTERNAL URETHROTOMY. This is indicated in stricture of the posterior urethra of small calibre and not amenable to dilatation. It may be of the tough, fibrous character or resilient. Complication by extravasation of urine or fistula behind the stricture adds indications, as does retention of urine or incontinence. The free drainage afforded by this operation is essential in some cases of cystitis resulting from stricture.

In its performance a grooved staff with a slender extremity is introduced through the stricture, if possible, till the shoulder at the junction of the slender portion with the larger part of the instrument comes in contact with the stricture. Then, the shoulder having been located with

the finger, it is cut down upon in the median line of the perineum, and a straight bistoury or a special probe-pointed knife is passed along the groove toward the bladder, cutting into the floor of the urethra till the stricture is completely divided. A free passage having been established, a grooved director is introduced into the bladder, the staff withdrawn, a rubber catheter inserted through the incision and tied in by threads attached to the margin of the wound. If it is impossible to introduce the guide through the stricture an effort may be made with filiform bougies. If one becomes lodged it should not be withdrawn, but others inserted, one by one, till finally one passes into the bladder, when a tunnelled staff may be slipped down over it. If no staff or bougie can be inserted through the stricture a sound may be passed down to it, its beak depressed and cut down upon, and another attempt made to pass the stricture through the incision. In case that fails supra-pubic incision of the bladder and passage of the stricture from behind have been proposed, and doubtless would be better than the mutilation sometimes made in trying to find the channel from below. If fistula or swelling from extravasated urine or abscess is present it should be laid open and drainage provided. The length of time for the perineal incision to be kept open depends on the amount of cystitis present; much better drainage of the bladder is secured through the perineum than through the penis. As soon as the condition admits the catheter should be passed through the penis and the incision allowed to close; it does so spontaneously if not too long delayed. Sounds must be used after this operation, as well as any other, to prevent recontraction.

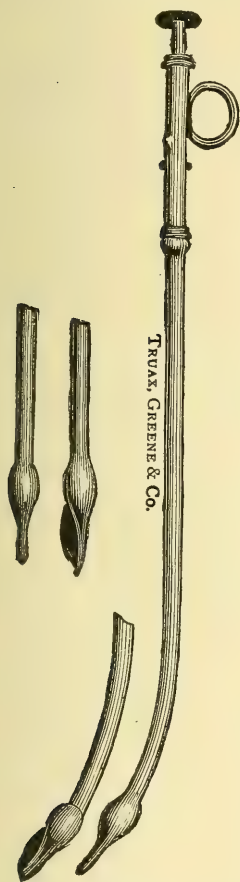


Fig. 694.
Gross' Urethrotome.

COMBINED INTERNAL AND EXTERNAL URETHROTOMY. This operation is growing in favor. It is an addition of perineal drainage to ordinary internal urethrotomy done in the anterior urethra. It eliminates from the wound the irritating effect of urine in the urethra and affords complete physiological rest under aseptic conditions. It is reported that some strictures have disappeared spontaneously when the urine has been diverted through the perineum. The perineal incision is made only large enough to conveniently pass a catheter.

EXCISION. A few cases, mostly traumatic, have been treated by excision of the cicatrices, with varying success. Grafts of mucous membrane, transplanted after Thiersch's method, have been employed in external urethrotomy to piece out the urethral lining at the contracted place. (Wolfler, Mayo, Robson, Keyes).

ELECTROLYSIS. As a means of relieving stricture electrolysis has been favorably reported on by a few, but it has not become established in general favor.

HYDRAULIC PRESSURE. Hydraulic pressure from a column of water four feet high applied to a stricture for an hour at a time, if necessary, has dilated impermeable stricture so that the water passed on to the bladder, and a filiform bougie could be introduced and followed by a tunnelled guide. In the application of the pressure a catheter with an open end has been passed down to the stricture and the penis compressed around it.

Urethral Vegetations and Polypi.—These sometimes form and give rise to symptoms of stricture. Their presence is made out by inspection with urethral speculum or urethroscope, and they may be removed by forceps or snare.

Catheterism.—Enlargement of the prostate and stricture of the urethra are the principal causes of retention of urine and the use of a catheter. With these two causes as a basis the author classifies his cases as requiring large catheters or small ones. In cases of enlarged prostate without stricture large sounds or catheters smooth out folds of mucous membrane and push projecting masses out of the way with much less liability of injury than smaller ones. Where there is room for it a large instrument passes more easily than a small one, and often where a small one will not at all. Before trying any catheter the channel is searched out and straightened out if possible with a large, smooth, steel sound, then immediately followed by a soft rubber catheter of nearly equal size, with a stiff wire in it of the same curvature as the sound. If difficulty is met with in passing the catheter the wire is withdrawn a little so as to leave the end limber. The lengthening of the urethra and its curvature is always born in mind. In retention of urine from stricture a small instrument must be used, and the stricture previously dilated, if need be. If the stricture is impermeable by ordinary instruments filiform bougies or hydrostatic pressure may be employed as described under Stricture. In the selection of catheters the author prefers soft rubber, usually used with a wire, and has no use for metal ones with inadaptably curved eyes that cannot but injure the mucous membrane. The little metal catheters usually put up in pocket cases are useless in the hands of experts and dangerous in those of amateurs.

In cases where it has been impossible to introduce the catheter aspiration above the pubis for temporary relief is preferable to the same operation through the rectum.

For the use of a sound or catheter the patient should be in reclining posture with the shoulders a little elevated and the thighs separated. The attendant, standing on his left side, pulls upward on the penis with his left hand, enters the previously warmed and lubricated instrument with the handle depressed over the left groin. As the beak approaches the symphysis the handle is brought round over the median line of the abdomen and pushed gently downward till the beak is felt by the left hand below the scrotum. Then the handle is elevated and the beak pressed upward with the left hand. The beak should be kept hugging the floor till the bulb is reached, then the roof. Its passage into the bladder is indicated by the deflection of the handle without resistance and the escape of urine, if a pervious instrument is used. Some prefer to begin the introduction with the handle downward and afterward rotate—a procedure apt to be painful when the instrument is metal and

has an eye. The whole process should be very slowly done to avoid spasmodic resistance, and very carefully done to avoid injury. In most cases where habitual use is required, patients soon learn to do it themselves.

CHAPTER V.

PROSTATE GLAND—SCROTUM—TESTICLES.

Chronic Inflammation and Abscess of Prostate Gland.—

When acute prostatitis was considered under the sequelæ of gonorrhea, it was stated that it usually terminated in a short time by resolution, but the recovery is not always complete. Another form not traceable to gonorrhea, and occurring mainly in men past middle age, has been observed. When persons with prostatitis have succumbed to other diseases post mortem examination has shown its racemose glands and utricles largely distended with secretion containing pus, and the intervening tissue either atrophied or hypertrophied so as to cause enlargement of the gland. The neighboring connective tissue is infiltrated, and sometimes involved in the abscesses formed.

SYMPTOMS. Subjective symptoms are a sense of weight and tenderness in the perineum, pain in the rectum and glans penis, frequent desire to urinate, with pain of contraction at the close of the act, and discharge of viscid fluid, perhaps tinged with blood. Patients commonly suppose the discharge to be semen, and the rectal irritation caused by the passage of hard stools over the swollen and tender gland to be due to piles. Despondency is the usual result of such mistaken impressions, added to the real ills. Seminal emissions are apt to be painful, and sexual desire lessened. Impotence may result.

Objective symptoms are obtained by digital examination through the rectum, and examination of the discharges expressed by the finger. The finger in the rectum detects the tender, swollen and irregular gland and the swelling of the seminal vesicles that usually accompanies. Fluctuation may be felt when pus has formed. The secretion may be obtained for examination by expressing with the finger, and collecting, after expulsion by the urethra, or by the triple glass method of collecting the urine described under vesiculitis. Tubercular disease of the gland causes a more nodular contour; other localizations and general signs of that affection are also apt to be present.

TREATMENT. The use of large sounds, sometimes cold, sometimes hot, is beneficial. Stricture rarely occurs in this portion of the urethra, but the compression of the substance of the gland and the straightening out of the irregularities of the channel are desirable. Irrigations of the posterior urethra may be made with hot hydrastis solution, allowed to run into the bladder till it is full, then voided in the natural manner, and continued daily for weeks. Instillations of a few drops of solution of zinc sulphate or silver nitrate may also be made. The rectum should be kept clear of accumulations and hemorrhoids, and other irritable conditions removed. Suppositories, or starch water enemata, containing belladonna and hamamelis, help toward recovery. Daily injections of 20 or 30 minims of the solution of the tri-chloride of iodine, 1 to 1,000 or 2,000 of water, have been made into the substance of the gland through the per-

ineum. When abscesses form they more frequently open into the urethra, but sometimes into the rectum, and sometimes the pus is diffused through the neighboring connective tissue. If fluctuation is at any time detected the pus should be evacuated through the perineum, not by incision within the bowel.

Hypertrophy of the Prostate.—This condition does not usually attain development sufficient to attract attention till about the fiftieth year, but examinations made for other reasons show that the gland is often subject to considerable enlargement at a much earlier age. About one-third of all old men are subject to it. The cause is obscure, but good living probably disposes to it; in a dozen years' experience in the dissecting room, where paupers were the source of supply, the writer did not see a case.

Hypertrophy consists mainly of an overgrowth of the fibrous and muscular elements. The enlargement may be quite uniform, but generally is in circumscribed areas, so that the hypertrophy is irregular. The rounded masses project in the direction of the least resistance—into the urethra, causing irregular deflection of the channel, and into the bladder, forming masses, some of which are inclined to turn over the entrance to the urethra in a valve-like form.

The symptoms are frequent desire to urinate, difficulty in starting the flow, feebleness and frequent interruptions of the stream, with uneasiness in the vesical region. Headache, lack of appetite and malaise are often caused by a mild uremia, due to residual urine and retro-ureteral pressure. Finally, as the obstruction and irritation increase exposure to cold and wet causes sudden and complete retention of urine.

Examination by the finger in the rectum reveals enlargement in all degrees up to the capacity of the pelvis. The contour and consistency of

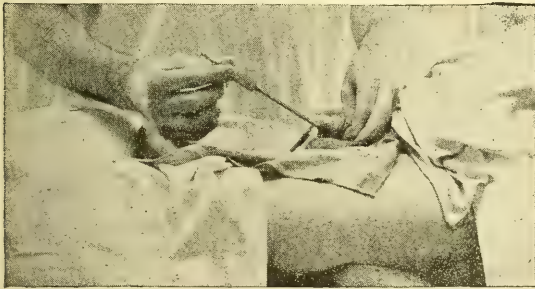


Fig. 695.

Searcher Introduced over Enlarged Prostate.

the rectal surface give some clue to differentiation from tuberculosis and malignant disease. By the use of sounds in the urethra, stricture that causes similar subjective symptoms may be excluded, and the absence of stone in the bladder ascertained by searching. (Fig. 695). Introduction of a catheter after micturition sometimes discloses

residual urine. The residual urine by decomposition becomes irritating and causes cystitis; if much distension has continued for a long time dilatation of the ureters and extension of trouble to the kidneys occur.

TREATMENT. Exposures to cold and wet and excesses in eating and drinking aggravate the obstruction, probably by causing congestion, and should be carefully avoided. The drinking of large quantities of water, preferably hot, dilutes the urine and reduces irritation in the bladder and prostate. Avoidance of constipation removes another source of irritation. The introduction of large sounds helps to keep the channel open. The use of saw palmetto and queen of the meadow sometimes causes

reduction of the gland, and the drinking of hard cider has been credited with the same effect.

After everything possible has been done to prevent residual urine what remains should be regularly drawn with a catheter, and if cystitis is present the bladder should be daily washed with water, boric acid, Thiersch's solution, etc., through the catheter. Intelligent, careful men can get along this way in comfort and health for years; but if the use of the catheter becomes impossible resort may be had to a variety of procedures.

Recently castration has been proposed as a very effective means of securing atrophy of the hypertrophied gland and relief of the obstruction caused by it. Experience is not yet great enough to determine its value, but if it proves as successful as it promises it will be a great boon.

When other means of securing evacuation of urine have failed a fistula above the pubis or through the perineum may be established. Above the pubis cystotomy may be made, or simple puncture with a trocar, the canula being retained to secure patulence. A special

canula has been devised by Bangs. Guided by the finger in the rectum, puncture with a trocar may be made through the perineum and substance of the gland; later a catheter may be introduced. (Fig. 696.)

More radical operations have been done through the urethra, through the perineum, above the pubis, and by high and low operations combined.

Through the urethra projections into the bladder near the entrance to the urethra have been seized, severed and removed by Mercier's instrument, a modified lithotrite with sharp instead of serrated jaws. The bladder is partially

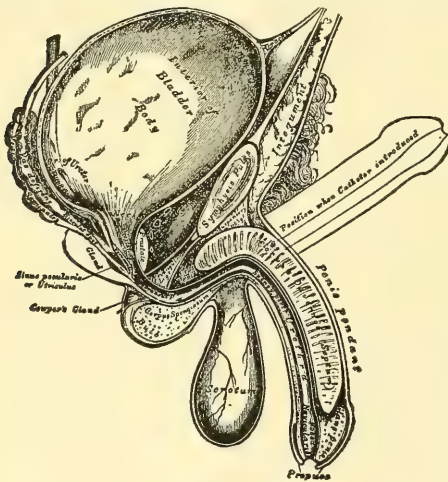


Fig. 696.
Showing Penile Position of Catheter.

tially filled with water during the operation. This method is applicable to small masses with small bases, but the uncertainty of diagnosis of such cases causes a great deal of guesswork in the operation, and it is not frequently done.

Perineal urethrotomy furnishes a route through which enlargements of the middle lobe are rendered barely accessible. Any considerable hypertrophy elevates the vesical neck beyond reach by the finger through the perineum, so that the removal of projections within the bladder must be mainly guided by instrumental touch.

Supra-pubic cystotomy affords the advantage of ocular inspection of the interior of the bladder and of the work done there, and has been the favorite route for prostatectomy. Hemorrhage that often attends removal of masses projecting into the bladder has been controlled by umbrella-shaped compresses pulled downward by a catheter through the urethra. In this or either of the other methods of excision involving the mucous

membrane of the bladder free exit for urine must be provided till the possibility of urinary extravasation is passed.

As it is not possible to reach intra-urethral projections by supra-pubic cystotomy perineal incision has been added to it as a means of reaching that locality. This combined method makes it possible to clear away all obstructions, but it has in the highest degree the element of danger to life. Before they will submit to operation most men who are in declining years to begin with become weakened by inflammation, sepsis and suffering till they are in poor condition to endure anesthesia, shock, and the continued contact of urine with raw surfaces afterwards. They should be operated before they have reached such a condition. Operation is indicated when medicinal and local treatment fail and the vesical symptoms grow progressively worse.

Cancer of the Prostate.—This affection is comparatively rare, and is peculiar among cancers in that a respectable minority of cases, ten to twenty per cent., have been found in boys under ten years old. Of the growths seven-eighths are carcinoma, and the remainder sarcoma. At first distinction from simple hypertrophy may be difficult, or the disease may be grafted on hypertrophy, but severe pain and passages of blood are diagnostic. Examination through the rectum discloses nodular enlargement.

TREATMENT. The treatment is palliative only. The relation of the gland is such as to offer no hope of eliminating the disease by extirpation. Supra-pubic fistula may be made when the catheter can no longer be used.

Scrotum.—The skin covering the scrotum is thin, very elastic, and without subcutaneous fat. In the upper part a cellular interval intervenes, but below it is quite intimately connected with the muscular layer beneath, so that it is thrown into rugæ by the contraction of that layer.

The dartos is the reddish layer of involuntary muscular fibres immediately beneath the skin, and an important support of the testicles. It is continuous with the superficial fascia of the surrounding parts, invests the testicles, and sends a septum between them.

Between the dartos and the cremaster below is a layer of fascia, the intercolumnar or spermatic, in which effusions of serum or extravasations of blood or urine take place.

The cremaster consists of loops of striped muscular fibre, continuous above with the internal oblique muscle and loosely connected by the infundibuliform fascia to the cord and tunica vaginalis. By its contraction it draws the testicle toward the inguinal canal.

The tunica vaginalis is a serous sac with a visceral layer covering the testicle, except at the posterior border, and a parietal layer lining a corresponding portion of the wall. The space between the two, ordinarily in contact, is that occupied and distended by effusion in hydrocele.

ABNORMAL DEVELOPMENT OF THE SCROTUM. The scrotum is cleft in hermaphroditism and perineal hypospadias, and variously modified in extrophy of the bladder and epispadias. In non-descent or absence of the testicle it remains contracted and atrophied. It is occasionally hypertrophied from obstruction of the lymphatics.

INJURIES. The scrotum is liable to the same kinds of injury as other genital parts, and, from its ready distensibility, affords a convenient receptacle for blood, pus, or extravasated urine. Its wounds, accidental or surgical, require, in addition to the usual surgical cleansing and dressing, special care in affording support and compression to prevent and remedy the swelling from extravasation. Pus or urine should be evacuated by incision.

ELEPHANTIASIS. The scrotum is liable to this affection, particularly in natives of warm climates. It is supposed to be due to inflammatory obstruction of the lymphatics, caused by parasites, the *filariae sanguinis hominis*. The progress of the disease is slow, extending over years, but the hypertrophy caused by it is immense. Erythematous attacks sometimes occur, though mechanical inconvenience is the principal trouble caused by it.

Treatment. When seen early compression and electrolysis are said to have produced beneficial results. After considerable hypertrophy has occurred removal has been successfully practiced. The testicles and penis are usually saved, skin-flaps from neighboring parts being pulled over them when necessary. The free hemorrhage caused by the operation is controlled by compression of the pedicle (see Elephantiasis Arabum).

TUMORS. Sebaceous retention cysts are the most common. Simple incision and expression of contents are usually sufficient to cause their disappearance. Urinary cysts, dermoid cysts and angiomas are sometimes found. Hematoma readily forms in the scrotum. Support and compression assist its absorption; if it becomes the seat of suppuration incision is necessary.

Epithelioma is the usual form of malignant disease of the scrotum. It was formerly called chimney sweep's cancer, irritation from soot being the supposed excitant. Those who work in coal tar products and in smelters are said to be more frequently affected by the disease.

A warty growth after continuing for years may gradually assume a malignant character, and produce a fatal result unless prevented.

Treatment. Prompt and thorough excision.

Testicles.—These glands are suspended in the scrotum by the combined action of the cord, the cremaster and dartos muscles, in such a position that the upper extremity looks upward, outward, and forward. Their average size is about one and one half by one inch, the left a little larger and lower than the right. They are originally developed in the abdomen, and normally are drawn down into the scrotum by the gubernacula before birth; but the descent of one or both may be arrested at any point, so that it may remain in the abdomen, in the inguinal canal, or between it and the bottom of the scrotum; or it may miss the scrotum and pass under the skin of the perineum, groin or thigh.

The epididymis is composed mainly of convolutions of about twenty feet of the first part of the excretory duct. It is attached to the posterior border of the gland in its upper and lower portions and is covered laterally by the tunica vaginalis. The upper extremity is called the globus major, and has projecting from it one or more small, pedunculated, serous-covered masses of connective tissue and vessels, the hydatids of Morgagni, remnants of the duct of Mueller. The lower extremity, in which the vas deferens has its origin, is called the globus minor.

The tunica albuginea, just beneath the serous coat, is a dense white layer of fibrous tissue that forms the sac which contains and supports the soft and yielding gland substance. Along the posterior border a process of this membrane is projected into the mediastinum of the testicle, and by subdivision forms between three and four hundred conical compartments, in which the gland substance is contained, and upon the walls of which the blood vessels ramify.

The gland substance consists of two or more tubuli seminiferi, convoluted and packed into each of the conical compartments formed by the fibrous membrane. The tubuli are from one to two feet long and from one one-hundred-and-thirtieth to one one-hundredth inch in diameter. As the ducts converge toward the mediastinum they unite to form a smaller number, and are called tubuli recti. These unite to form a network in the mediastinum, the rete vasculosum testis, from the upper and back portion of which the twelve to twenty vasa efferentia pass upward to open into the single tube of the epididymis. The cone-shaped masses of these tubes form a considerable part of the bulk of the globus major.

VESSELS AND NERVES. The spermatic artery supplies the testicle and epididymis, except for a few small anastomosing branches from the artery of the vas deferens. Its branches penetrate the gland along the posterior border, where the returning veins emerge to unite in the pampiniform plexus. Sympathetic nerve branches accompany the vessels.

SPERMATIC CORD. This, while in the scrotum, has the same covering as the testicle, except the tunica vaginalis. In the upper part of the scrotum the dartos loses its muscular character and a layer of connective tissue intervenes between it and the skin. The spermatic fascia and the cremaster become continuous with the abdominal muscles at the inguinal ring. In the inguinal canal the aponeurosis of the external oblique muscle is anterior to the cord.

The structures of the cord are the vas deferens, the spermatic artery, the artery of the vas deferens, the spermatic veins, sympathetic nerves and lymphatics. The spermatic, or pampiniform, plexus of veins consists of numerous anastomosing vessels that form the principal bulk of the cord. They are divisible into two groups, a larger one placed anteriorly with the spermatic artery, and a smaller one posteriorly with the vas deferens. The vas deferens passes along the inner posterior border of the epididymis and along the posterior portion of the cord up to the inguinal ring.

CHAPTER VI.

DISEASES OF THE TESTICLES AND URETHRA.

Anomalies.—Non-descent, misplacement, absence and supposed supernumerary numbers occur.

MISPLACEMENT. Misplacement of the testicle in the perineum, groin, or skin of the thigh may be remedied by a simple plastic operation; and incomplete descent may be improved by pressure, when the testicle is within reach. Little can be done for other anomalies.

Atrophy.—This is of frequent occurrence. Occlusion of the seminal duct by orchitis; pressure from varicocele, hydrocele, hematocele or of a truss upon the cord; onanism; sexual excesses; syphilis and hypertrophy of the prostate are common causes.

TREATMENT. When due to sexual excess the administration of saw palmetto may be of benefit. Generally more can be done to prevent the trouble, by early removal of causes, than for its cure.

Inflammatory Diseases.—**ACUTE ORCHITIS.** Inflammation of the gland may be associated with gonorrhea, that disease usually being arrested by the epididymis. Traumatism, mumps, pyemia, smallpox, scarlet fever, syphilis, tuberculosis, rheumatism and gout have been assigned as causes.

Symptoms. The disease being within the comparatively unyielding tunica albuginea, swelling cannot become great unless the inflammation has existed for some time, or the epididymis is also involved; but the pain is more severe on this account. In addition to the severe pain and nervous irritability, fever, with anorexia, nausea, vomiting, hiccough and insomnia, is present. In many instances the pain subsides in a few days, when resolution generally occurs. Suppuration sometimes occurs, pus burrowing to the surface unless previously evacuated.

Treatment. Rest and hot compresses, with the gland elevated and the internal administration of aconite, belladonna, pulsatilla, mercurius or hepar. If incision is made for suppuration or spontaneous opening occurs care should be taken to prevent hernia of the gland substance, producing what is known as fungus testis benignus. Occasionally small pus formations deep in the gland may become inspissated and gradually absorbed or calcified. More destructive inflammation may cause gangrene and considerable loss of tissue.

Chronic Orchitis.—This condition may succeed the acute form, when suppuration and the formation of fistula have occurred, or when induration persists. It may be circumscribed or diffuse, and the swelling varies correspondingly. Occasionally the enlargement becomes great. A succession of abscesses and fistulae may form. The affection is liable to be confused with chronic peri-orchitis, tuberculosis, syphilis and neoplasms.

TREATMENT. If the disease is secondary to inflammation within the urethra local treatment there is indicated. If fistula is present it may

be laid open, curetted and packed with gauze, in an effort to secure closure; but prompt cure lies in castration only.

Chronic Epididymitis.—In this affection the increase in size and induration are commonly due to hyperplasia of connective tissue between the tubular convolutions. Sometimes it presents considerable resemblance to scar tissue and differs materially from syphilitic deposits. Again, the callous tissue softens and abscesses occur. (Kocher.) The pus sometimes comes to the surface and sometimes becomes encysted. Cases have been reported in which cystic distension of the epididymal canal was present.

The chronic form of the disease usually succeeds the acute. An indurated, tender spot persists in some portion, and exacerbations of inflammation occur. The tunica vaginalis is often involved in the process, constituting an adhesive or serous peri-orchitis.

TREATMENT. Support by a suspensory, abatement of urethral inflammation and abstinence from coition palliate the trouble and may assist in recovery in mild cases. Kocher recommends excision of the indurated masses when circumscribed. When the whole of the epididymis is involved castration may as well be done early as late.

Syphilitic Testicle.—Gummy infiltration of connective tissue occurs in both the epididymis and testicle, in diffused or circumscribed forms, and at any length of time after primary manifestations of the disease. Syphilitic deposits have little disposition to suppuration. Absence of pain and inflammatory symptoms distinguish them from other forms of orchitis and epididymitis, and the history of syphilis furnishes a very probable ground for diagnosis. Tubercular disease is more apt to begin in the globus minor; syphilitic, in the globus major. Tuberculosis follows a more rapid course, is attended by more pain and tenderness and frequent abscess formation; the vas deferens, prostate, and seminal vesicles are apt to be also involved. Carcinoma and sarcoma grow more rapidly, are more painful, more irregular in contour, and rupture and decay without softening.

TREATMENT. Iodide of potash and mercurius biniodide confirm the diagnosis, and cause diminution or disappearance of the enlargements.

Fungus Testis Benignus.—This is hernia of the gland substance, occurring through an opening of the tunica albuginea and overlying tissues. The opening may be caused by incision or spontaneous opening of an abscess, and pressure from within pushes out a varying quantity of the soft mass of seminal tubules. There is little disposition to spontaneous return of the protruding mass and less toward healing over. The granulating, rounded protrusion may persist indefinitely.

TREATMENT. If the condition has been the result of syphilis it is reported that anti-syphilitic treatment causes its disappearance. If it has been produced by simple orchitis, and no fistula is present, excision, scraping, and cauterization of the base may cause it to heal. If it complicates tubercular disease, or has resisted other treatment, castration is called for.

Neoplasms.—The testicles are subject to benign and malignant new growths. Benign formations are distinguished from other enlargements by their circumscribed form, slow growth and absence of inflammatory symptoms. They are more often of the cystic or fibrous character.

TREATMENT. If they cause mechanical inconvenience or present any suggestion of malignancy they should be removed by enucleation, if possible; otherwise by castration.

Malignant growths are scirrhus, encephaloid, or sarcoma. Pain, irregularity of contour and exceptional hardness in the one case and softness or rapidity of growth in another are characteristic.

TREATMENT. Removal.

CASTRATION. Different details are observed in this operation by different operators. Some do not ligate the cord entirely for fear of causing pain by pressure on the nerves, but tie arteries separately. Some of the same persons do not let the cord retract, from fear that their ligatures may slip off and troublesome bleeding occur in a place not easily accessible. The author does not share either of these fears. He passes a silk worm-gut ligature down through the skin above the upper end of the incision, under the cord and out again a quarter of an inch from the point of entry. This is tied firmly over a little piece of gauze before the cord is cut off, and prevents both retraction and hemorrhage. It is removed with the other sutures, or sooner, and leaves no foreign substance in the wound. Unnecessary scrotal tissue is removed by elliptical incision, the wound sutured, a small piece of gauze inserted at the lowest point, and snug compression applied for a few hours.

Hydrocele.—Hydrocele is classified according to the location of accumulated fluid. The more common site is the tunica vaginalis testis.

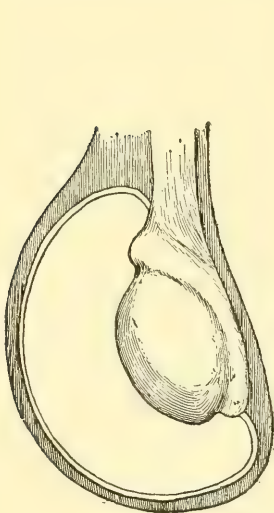


Fig. 697.
Hydrocele of the Tunica
Vaginalis.

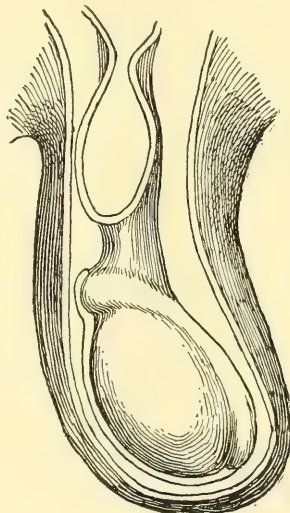


Fig. 698.
Hydrocele of Cord Commu-
nicating with Abdominal
Cavity.

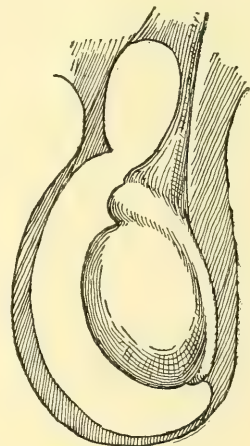


Fig. 699.
Hydrocele of Cord Commu-
nicating with Tunica Va-
ginalis.

(Fig. 697). In hydrocele of the cord the fluid is in an unobliterated portion of the processus vaginalis peritonei. It may be confined at both ends so as to form a circumscribed cyst, or it may communicate with the peritoneal cavity (Fig. 698), so that the fluid is reducible, or it may communicate with the tunica vaginalis (Fig. 699), forming a tubular prolongation of that cavity. Again, in congenital hydrocele, or hydrocele

communicans, the channel is open from the tunica vaginalis to the peritoneum. In the rare form termed diffuse hydrocele of the cord the fluid is in the connective tissue of the cord. Hydrocele of the cord and of the tunica vaginalis may coexist, constituting bilocular hydrocele. Complication of hydrocele of the tunica vaginalis, as by effusion of fluid between that membrane and the tunica albuginea, constitutes another form of bilocular hydrocele. Several cysts along the cord form multilocular hydrocele. Hydrocele may be complicated by the presence of other varieties of cysts, by hernia, and different inflammatory conditions. It is acute or chronic, a distinction of considerable clinical importance.

ACUTE HYDROCELE. This is seldom a primary disease, but attends the majority of acute inflammations in the scrotum, though it is often overlooked. Epididymitis is the most frequent cause, and the scrotal swelling in that disease is in part due to hydrocele. Injuries of the scrotum or contents are other causes.

Diagnosis. Acute hydrocele coexisting with other morbid conditions is less easy of diagnosis than the chronic. Fluctuation, translucency and exclusion of hernia make its presence pretty certain. Hematocele, another result of injury, can be differentiated by its failure to transmit light, and the possible detection of blood clots. Removal of a little fluid through a small needle settles the diagnosis.

Treatment. As the condition is usually secondary the treatment should be directed mainly to the primary affection. Rest, elevation and compression by being packed in large, hot compresses, or by adhesive strips, are desirable local measures. Aspiration is not usually needed; but if rigors, increase of fever and perspiration point to pus formation incision and antiseptic dressing are indicated.

CHRONIC HYDROCELE. This is the condition ordinarily meant by the term hydrocele. It may occasionally be a continuance of the acute form, but usually develops without inflammatory symptoms. A lack of balance between secretion and absorption seems to be about the only reason for the accumulation. It does not form in connection with dropsical effusions in other serous cavities.

Resembling this affection in the accumulation of fluids are the inflammations termed chronic peri-orchitis, prolifera, adhesiva and hemorrhagica.

In the prolifera extensive fibrous thickening of the wall and roughening of the inner surface of the tunica vaginalis occur. The hypertrophy of fibrous tissue may become so great as to cause absorption of the epididymis or testicle.

In the adhesive form the epithelium becomes destroyed in places and adhesion of visceral and parietal layers, more or less complete, occurs.

In the hemorrhagic form the lining membrane is highly vascular and often bleeds spontaneously, or from slight injury. Suppuration occurs in any form after infection.

The diagnosis of hydrocele is usually easy; that of the allied affections less so. Confinement of the tumor to the scrotum and absence of enlargement extending upward to the inguinal canal exclude hernia. The form and appearance are so different from varicocele that bare inspection is sufficient to distinguish them. Fluctuation and transparency establish the diagnosis, though a dark-colored fluid sometimes prevents

transmission of light. In the cases of thick-walled periorchitis translucency is less marked and fluctuation less easy of detection, but a hypodermic needle reveals the character of the contents.

Treatment. The treatment of simple, non-inflammatory hydrocele varies with the age of the patient. In infants circumcision, or circumcision and aspiration are usually followed by disappearance of the trouble. In recent cases in adults rest in bed with elevation of the part is occasionally followed by disappearance, though other measures are needed in most cases.

Aspiration and injection of 20 minims of carbolic acid are sometimes curative. Manipulation should be made to bring the acid in contact with all parts of the lining. If the first injection should not succeed another larger one should be made. Sometimes the canula may be left in situ for twenty-four or forty-eight hours, causing sufficient irritation to obliterate the hydrocele.

In cases that have resisted this treatment free incision, stitching of serous membrane to the skin and continued packing with gauze—all under antiseptic precautions—should be resorted to. In cases of periorchitis

the diseased parietal layer of the the tunica vaginalis should be removed.

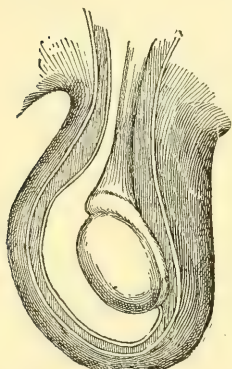


Fig. 700.
Congenital Hydrocele.

CONGENITAL HYDROCELE. (Fig. 700). Distinguished from the usual forms by the possibility of pressing the fluid into the abdominal cavity. The fluid may be withdrawn by aspiration, but no irritating injection should be made for fear of exciting peritonitis. In infants spontaneous adhesion sometimes occurs, and pressure upon the inguinal canal by a truss has caused adhesion in adults.

ENCYSTED HYDROCELE OF THE CORD. (Fig. 701). This forms a smooth, oval, translucent tumor of the cord, somewhere between the testicle and the abdominal cavity. It occurs more frequently in young children, and usually does not return after aspiration. In persistent cases in children or adults the same treatment should be followed as in hydrocele of the tunica vaginalis.

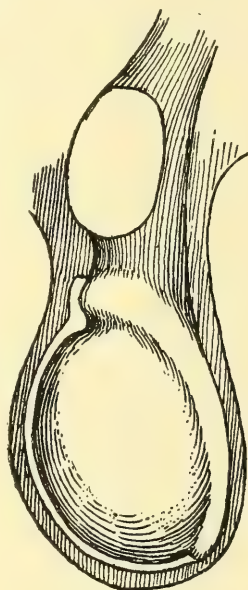


Fig. 701.
Encysted Hydrocele of Cord.

DIFFUSED HYDROCELE OF THE CORD. This is a rare disease, an edema of the cord, limited by the fascia Cooperi. It may extend as a rope-like swelling from the testicle up through the inguinal canal and about two inches along the psoas muscle. It has been attributed to rupture of cysts or obstruction of the spermatic veins, but with some uncertainty. The swelling is reduced in the recumbent posture, and a good portion of the fluid can be pushed into the abdomen, but immediately returns on removal of pressure. Omental hernia most resembles it, but translucency of the fluid serves to make the distinction.

Treatment. Incision, drainage, compression, and the carefully selected homeopathic remedy.

Spermatocele.—This is a cyst resulting from obstruction or rupture of one of the vasa efferentia near the rete testis. The usual site of the tumor is between the testicle and epididymis. As it grows it extends upward, increasing in diameter. Its conical or pear shape, with the apex between the testicle and epididymis, serves to distinguish it from hydrocele or other cysts. Detection of spermatazoa in a little fluid withdrawn by a hypodermic syringe confirms the diagnosis. If hydrocele coexists, communication between the two cysts may occur, constituting hydro-spermatocele.



Fig. 702.
Double Hydrocele.
—Macdonald.

TREATMENT. Tapping, incision and drainage, and excision have been practiced.

Varicocele.—This is a varicose enlargement of the veins of the spermatic cord, the usually present on the left side only, some-

pampiniform plexus. It is sometimes on both sides, and rarely on the right side only. Pressure upon the spermatic veins by the sigmoid flexure and contents is doubtless the main reason for its greater frequency on the left side. The condition develops between the ages of puberty and majority, and causes considerable anxiety in the minds of young men who read the newspapers. Dragging-down sensation, pain in the back and unusual fatigue in the erect position are the physical discomforts caused by it. Long continuance of considerable enlargement causes atrophy of the testicle from compression.

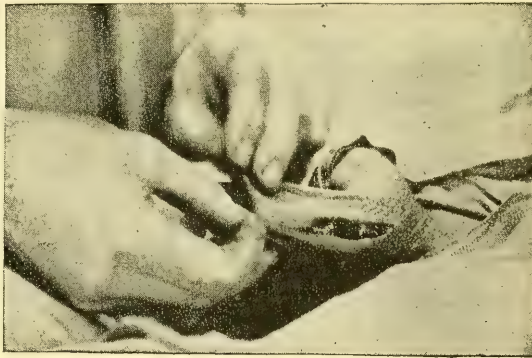


Fig. 703.
Incision for Radical Operation for Varicocele.
—Macdonald.

DIAGNOSIS. The diagnosis of uncomplicated varicocele can usually be made by inspection, the contour of the veins showing through the skin. Feeling of them makes the matter doubly sure.

TREATMENT. In cases so slight as to cause little danger of atrophy of the testicle a well-fitting suspensory may be worn and care taken to avoid constipation. In other cases where greater enlargement exists treatment for obliteration of the veins may be undertaken by one of two methods—ligation or excision.

Subcutaneous ligation with silk was formerly the method selected in most cases. In its performance, the enlarged veins having been separated from the other structures of the cord, a needle threaded with silk is passed through the pinched-up piece of scrotum beneath the veins and then passed back again through the same skin openings, but in front of

the veins, tied firmly, cut off short, and sunk into the tissues. To make sure that the ligature will be buried on both sides the author first pinches up the scrotum and transfixes it with a tenotome, so as to bring the small incisions where it is desired to have the needle make entry and exit.



Fig. 704.

Radical Operation for Varicocele. Incision united; lower angle of wound stitched to upper, converting longitudinal into transverse wound, thus shortening the scrotum.—Macdonald.

Excision of large masses of veins and of redundant scrotal tissue is sometimes desirable, and if performed with perfect asepsis no unpleasant consequences result. In performing it, suitable incision having been made, the veins are carefully isolated, ligated above and below, excised, the two stumps approximated, stitched together; instead of amputating the redundant scrotum, the wound closed with its lower angle stitched to the upper, thus converting the vertical incision into a transverse and thereby shortening the scrotum. (Fig. 704.)

The ligation and the joining of the stumps may be done with sheep-gut or with one of the superficial silk-worm sutures, passed through the deep structures and crossed before being brought through the skin. Elevation and snug compression should be maintained for several hours, to prevent extravasation of blood.

Urinary Extravasation.—This occurs through an opening in the urethral mucous membrane, produced by traumatism, follicular ulceration, or gradual distension, thinning and rupture behind a close stricture. The amount escaping soon after the injury varies from a very little to enough to cause extensive infiltration of connective tissue. The location of the opening above or below the perineal fasciæ determines the sites of infiltration. In the tissues the urine undergoes ammoniacal fermentation and becomes very irritating, enough so to cause extensive slough-



Fig. 705.

Urethral stricture with perineal fistula, with probes therein, a grooved staff being in bladder.—Macdonald.

ing in some instance. In this way the ischio-rectal fossa may be laid open and portions of the connective tissue and skin of the scrotum, penis perineum, abdomen and thighs destroyed. After separation of the sloughs the cavities close by granulation, except for a fistula, that persists indefinitely unless prevented or relieved. Septic fever attends local inflammation.

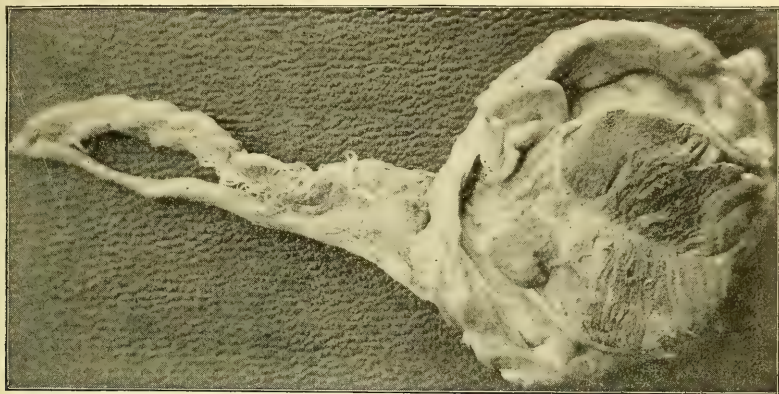


Fig. 706. Sarcoma of Epididymis.—Chislett.

TREATMENT. Early incision and drainage prevent the extension of the infiltration. Relief of the stricture by urethrotomy or cystotomy, or both, or retention of the catheter during the granulation process, usually enables the urethral opening to close.

Urethral Fistula.—An abnormal opening through which urine escapes may communicate with the rectum, appear on the surface of the perineum, or the under surface of the penis. (Fig. 705). Perineal fistula is the usual form, the others being rare. The fistula is apt to be tortuous and may have multiple openings. Cicatricial contraction tends to narrow the calibre so that only a small quantity of urine ordinarily escapes.

TREATMENT. Relief of the stricture of the urethra, so as to allow free exit of urine, is the first requisite.

In perineal fistula cauterization or scarification or curetting, with the retention of a catheter, may sometimes avail; but the more reliable method is external urethrotomy. (See Stricture.)

In urethro-rectal fistula through the prostate, resulting from abscess or other destructive process, the author has secured closure by scarification and suture within the rectum and a catheter tied in the urethra. Perineal section has been employed in other instances.

Penile fistula has been treated by cauterization, scarification, and excision of the fistulous wall, with suture of the wound. Where necessary a flap has been taken from the scrotum to close in the gap.

CHAPTER VII.

DISEASES OF THE BLADDER—VESICAL CALCULUS.

Etiology.—Normal urine carries away urea and various salts in solution. As a consequence of defective metabolism the solubility of waste products is often lessened, and they are thrown down in more or less crystalline forms. In the uric acid diathesis, very prevalent in this country, imperfectly soluble uric acid and urates replace a portion of the normal urea in the urine. Excessive uric acid formation occurs in children, especially those poorly nourished, and in persons of middle age who live well and do not get sufficient exercise. Sediments of oxalate of lime appear under similar conditions, particularly in those who eat much fruit. Phosphatic deposits occur mainly in old men with cystitis and residual urine, caused by enlarged prostate or urethral stricture. Many persons pass large quantities of these substances in their urine without these ever aggregating to form calculi. Sufficient irritation of mucous membrane to excite an albuminous secretion that may act to cement the particles is necessary for stone formation. Small calculi that have descended from the kidney, pieces of catheter, or foreign bodies of any sort may serve as nuclei around which secretions may form. (Fig. 707.)

Character.—The greater number of calculi form in acid urine, and consist of uric acid and urates; but the long continuance of stone in the bladder tends to excite cystitis and an alkaline reaction of urine, so that it often happens that subsequent phosphatic deposits occur about uric acid stones. Oxalate of lime deposits are also frequent in uric acid calculi. Second in frequency are calculi composed mainly of the earthy phosphates and carbonate of lime. Accumulations of cystine and indican are occasionally found. In rapidity of growth and in size the phosphatic variety leads. In contour the uric acid variety is the smoothest, the phosphatic considerably roughened, and the oxalatic so irregular as to be sometimes designated as mulberry calculi. In density the oxalate of lime calculi are the hardest, the phosphatic the softest. The number is usually one, but as many as a hundred have been found. When a large number are present they are worn into rounded forms by friction; when a small number they are faceted. The size of those successfully removed in this country has varied from nine and one-half ounces downward. Splitting or rupture of calculi, probably from contraction of the outer layers, has been reported.



Fig 707.
Vesicle Calculus with Slate Pencil.
—Shears.

Symptoms.—Frequency of urination is a rather constant symptom. It is more marked in young persons than in the old where diminished sensibility and atony of the bladder exist. Enlargement of the prostate, by forming a pouch behind it in which the stone may lodge, or the encystment of the stone in the wall of the bladder lessens this symptom. Motion aggravates it. As frequency of urination is also present in posterior urethritis, prostatitis, and cystitis without stone, the real significance of the symptom cannot be learned without physical examination.

Pain, particularly when the bladder closes down on the stone at the close of micturition, is a most suggestive symptom, but, like the previous one, it needs verification by examination. It is sometimes referred to the neck of the bladder, frequently to the glans penis, sometimes to the perineum, and sometimes it extends to the thighs or appears in the foot. It is much more marked in young people. Sudden stoppage of the flow of urine may occur from valve-like closure of the entrance to the urethra by the stone. Hematuria,

from abrasion of the mucous membrane of the bladder, frequently occurs. The amount of blood lost at any one time is small, and may need microscopic examination for detection.

Priapism is commonly present in young persons. Cystitis is less frequent with acid urine, but sooner or later develops and aggravates the pain and frequency of micturition. The sediments and the reaction of the urine often give a clue to the existence

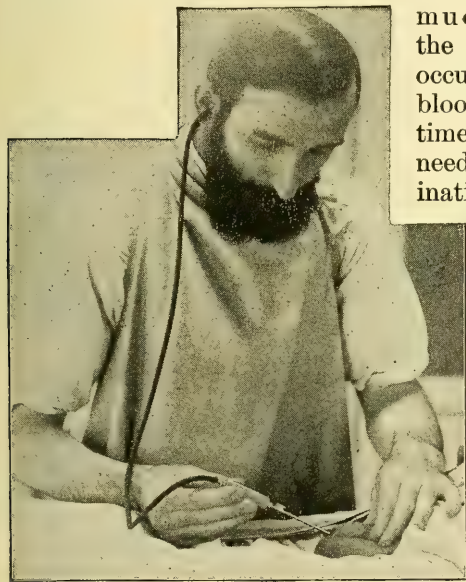


Fig. 708. Examination for Stone with Searcher.—Macdonald.

and character of calculi. Physical examination is the only way to interpret the subjective symptoms and definitely ascertain the presence of stone. It may sometimes be done by the finger in the rectum, but the more commonly practiced method is by a searcher in the bladder.

Sounding.—This is done with the patient in the horizontal position. In children or in sensitive persons general anesthesia is desirable, and it is sometimes best to be prepared for immediate removal of the stone, to avoid repetition of the anesthetic. In old men accustomed to the use of the catheter anesthesia is not necessary. A slender instrument, not larger than 15 Fr., is more freely movable and satisfactory, and a perforated one makes it possible to change the amount of water in the blad-

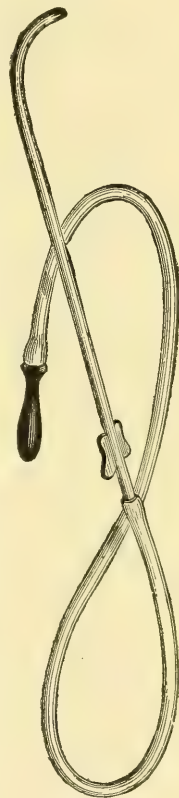


Fig. 709. Andrews' Searcher.

der during the search. The bladder should be partially distended, and, beginning at the bottom, a thorough systematic examination of its interior made by rotation, circumduction, and to-and-fro movement of the sound. Unless the stone is concealed in a pocket, or coated with mucous or blood, the impact of the instrument may be felt, and sometimes the stone may be sufficiently outlined for an approximate idea of its size, shape, smoothness and density. The discovery of a concealed stone in the floor of the bladder may be facilitated by a finger in the rectum, especially in children. A stone that has escaped touch may occasionally be brought in contact with the instrument by the patient's assuming the erect position and leaning forward while the water is allowed to escape. In other cases where severe cystitis makes drainage of the bladder desirable digital and instrumental examination of its interior may be made after the operation of high or low cystotomy.

Treatment.—This is preventive, solvent and operative.

PREVENTIVE. Every practitioner sees scores of cases having sandy urine, and has opportunity to prevent many cases of calculous formation. The correction of the uric acid diathesis is to be accomplished mainly by dietetic and hygienic regulation. Persons who are eating too much of unsuitable food and taking too little exercise should be induced to reverse the relation—work more physically and eat less and simpler food. Water in excess dissolves uric acid, and should be taken regularly in considerable quantities after digestion. Temporary palliation may be secured by drinking alkaline waters, but correction of habits is necessary for lasting relief. Nux, lycopodium, sulphur, sepia, or other remedy indicated by general symptoms assists in overcoming the tendency. Persons with oxaluria should observe similar precautions as to diet and exercise, and should use fruit sparingly—rhubarb not at all. Those with phosphate deposit in the urine may be divided into two classes—those subject to nervous wear and tear or debility, and those with enlarged prostate or other obstruction that induces decomposition of residual urine. The former need relief from anxiety and general building up, the latter, prevention of residual urine. (See Renal Calculi.) Prevention of deposit from decomposing urine is to be obtained by the regular use of a catheter to remove the urine and to wash out the bladder, and by removal of the cause, when possible.

SOLVENT TREATMENT. This is undertaken in two ways—by administration of desired substances by the mouth, to be brought in contact with the calculi as they are excreted by the urine, and by direct injection into the bladder. So much irritation attends the latter process that it cannot be continued for a sufficient length of time to effect much. Most success has been obtained from the injection of weak solutions of nitric acid for the solution of small phosphatic calculi. The action of solvents is greatly hindered by the mucous or albuminous coatings of the calculi. The alternate use of pepsin with the acid solution is of some advantage in clearing away the albuminous accumulation. For internal administration the salts of potash and lithia have most repute. Roberts, as a result of experiment, found that 40 to 50 gr. of the acetate or citrate of potash, administered once in three hours, secured the condition of urine most highly solvent of uric acid calculi. Over-alkaline condition is unsuitable, from the liability of phosphatic deposit over the surface of the stone.

The lithia salts are believed to have greater solvent power, and the prolonged use of the natural waters has been credited with the solution of small calculi. Piperazine has high solvent power upon uric acid crystals, but experience is yet too limited to determine its value as a solvent for stone. The solvent process is more valuable for the prevention of calculi and for the prevention of the reformation after removal than for the solution of any considerable concretions. It should not be attempted when other than quite small stones are known to be present, and may be regarded as very uncertain in any case.

OPERATIVE. The removal of stone is accomplished by lithotritry or litholapaxy, performed through the urethra, or by lithotomy, perineal, or supra-pubic section.

Previous to operation some preparatory treatment is desirable. Correction of hyper-acidity or alkalinity and abatement of cystitis should be secured, as far as possible. The presence or absence of renal disease should be ascertained for a guide to the use of anesthesia and in the selection of the mode of operation.

The method of removal of stone through the urethra has become so improved that it is the only one to be considered, except in the comparatively few cases where obstacles to its practice are present. It involves less danger to life, and does not, like the cutting operations, cause mutilation that may produce sterility, stricture, fistula, or incontinence of urine. Thompson has found it necessary to except only one case in thirty as not amenable to this operation.

The contra-indications for its use are narrow, undilatable stricture of the deep urethra; vesical tumor, severe cystitis and atony of the bladder, making perineal drainage desirable; very large and hard stone, and encapsulation of the stone, so that it cannot be seized by the lithotrite.

Lithotritry, or Litholapaxy.—Otis found out how greatly the urethra may be distended, and Bigelow how to comminute and extract stones through it. To the latter the great recent improvement of the operation and the name, litholapaxy, is due.

In the Bigelow method of operation, after moderate distension of the bladder with water, a lithotrite of as large size as can be easily passed, is well oiled and introduced, with special care in getting the beak to enter the opening of the triangular ligament and the prostate. If at any time leakage of water along the instrument occurs a piece of rubber tubing is tied around the penis. The instrument is pushed in till it impinges on the bladder wall, the male blade is carefully withdrawn till it meets resistance at the neck of the bladder, then it is pressed back, when it often



Fig. 710.
Bigelow's
Lithotrite.

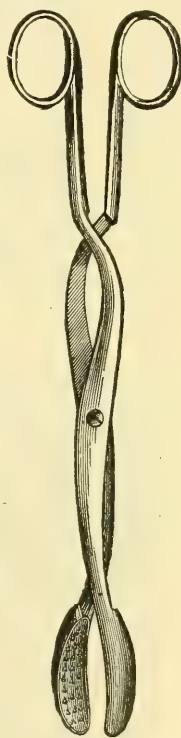


Fig. 711.
Little's Lithotomy
Forcep.

seizes the stone. If it does not do so it is rotated from side to side. If prostatic enlargement is present the jaws may be turned downward with the handle of the instrument depressed; or the hips of the patient may be elevated and a finger introduced in the rectum to roll the stone out of the depression behind the gland. No fecal matter should be in the rectum during the operation. When the stone is grasped it is crushed, (Fig 712) and the process repeated till all fragments are supposed to be reduced so that they will pass through the evacuating catheter. The lithotrite having been withdrawn, the largest catheter of the evacuator that will pass is introduced, sunk to the most dependent point of the bladder, and fluxion of water continued till no more debris can be obtained. (Fig. 713). Special care to get the last fragment is needed, for anything left becomes the nucleus for new formation. If any pieces are found too large to enter the eye of the catheter the lithotrite must be reintroduced, but effort should be made to have the first comminution complete. In cases of enlarged prostate the necessary bruising of the operation is apt to cause subsequent retention of urine. In any case where such a result is probable the tying in of a soft rubber catheter

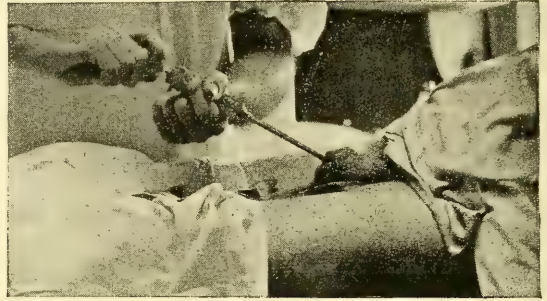


Fig. 712.

Crushing Stone in Bladder.—Macdonald.

at the close of the operation is a precaution against anxiety and possible difficulty in relieving the retention. After about ten days the evacuator should again be employed to search for and remove any fragments not previously secured. Occasional repetition of the process is a means of preventing recurrence.

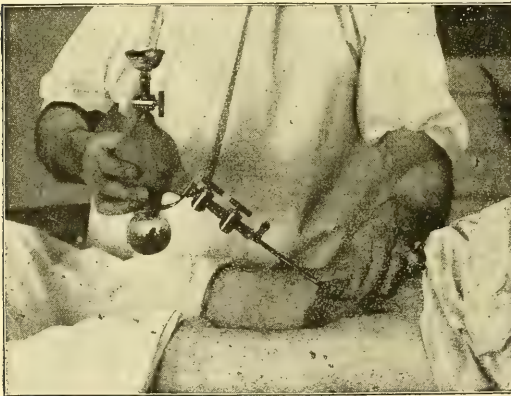


Fig. 713.

Evacuating Stone after Crushing.—Macdonald.

Some of the accidents and complications that may attend the operation of litholapaxy are hemorrhage from injury of the posterior urethra, nipping of folds of the bladder by the lithotrite, clogging of the instrument, cutting of the urethra by attempting to remove the lithotrite with a fragment in it, lodgment of a fragment in the urethra, and breaking or bending of the instrument so that it cannot be closed for removal. Liability to any of the accidents is lessened by carefulness and deliberation in the manipulation of the lithotrite. Any accident preventing withdrawal may be

met by supra-pubic cystotomy and direct removal of the cause and the remainder of the stone.

Lithotomy.—Cutting operations for the removal of stone from the bladder are done through the perineum and above the pubis. The perineal route has been most popular in the past, but of late the supra-pubic has become the favorite with some operators. Special conditions usually exist that give advantage to one or the other of the operations, and the choice should be determined by these considerations rather than by the fancy of the operator.

PERINEAL LITHOTOMY. This method is particularly indicated for medium-sized stones, when close stricture of the deep urethra or urethral fistula needing external urethrotomy complicates the case. Fig. 714. In prostatic hypertrophy, with projections that distort and obstruct the urethra, this method offers an opportunity for relief of that trouble as well as extraction of the stone.

It is done by the median, lateral or bilateral method. The lateral is the one more commonly followed; it gives more room and the incision through the prostate is in the direction where it can be made deepest without cutting

through the gland substance into the thinner wall of the bladder. It also does less harm to the seminal ducts.

LATERAL OPERATION. In its performance, the patient having undergone a few days preparation, his perineum is shaved, rectum and bladder washed out, and a few ounces of water left in the bladder.

He is then put in lithotomy position and a grooved staff is introduced and brought in contact with the stone, then assigned to an assistant. The operator makes an incision, Fig. 718, beginning near the raphe an inch and a half in front of the anus, and extending about three inches downward and outward to his right, between the tuberosity of the ischium and the anus. The anterior portion is made deepest and divides the skin, underlying fat, perineal fascia, transversus perinei muscle, the outer layer of the triangular ligament, and some of the hemorrhoidal vessels and nerves. The left forefinger is then introduced and the nail caught in the grooves of the staff for a guide, by which the knife is introduced and passed backward to the bladder, cutting the membranous portion of the urethra with its investing muscles and the prostate gland, the incision being turned a little more outward than the first. A gush of water announces the penetration of the bladder, and the incision is deepened from behind forward as the knife is withdrawn. The left forefinger is then introduced and brought in contact with the stone, the staff withdrawn, forceps passed along the finger, the stone

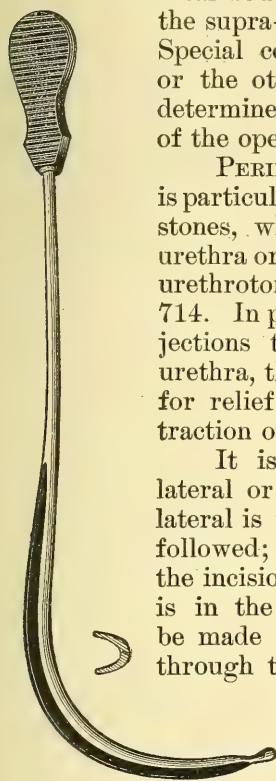


Fig. 714.

Little's Lithotomy Staff.

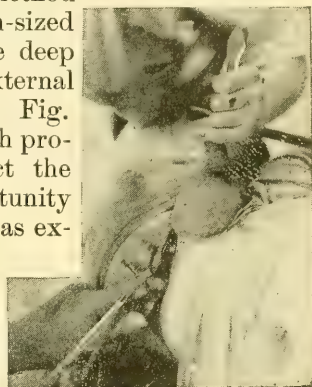


Fig. 715.

Bladder Opened and T Drain Introduced.—Macdonald.

seized and extracted. If it is in a pouch behind the prostate it may be reached with curved forceps or pushed upward by a finger in the rectum. The stone is removed entire, if possible; if too large it is crushed Fig. 712, and the fragments washed out. After extraction the interior of the bladder is examined by the finger to make sure there are no more fragments. At the close of the operation the bladder is washed with warm boric acid solution and small bleeding vessels are attended to. If much oozing occurs it may be checked by an umbrella-like compress, formed by tying a centrally perforated piece of gauze to a catheter, introducing it, and packing the interior so as to make lateral compression. No stitches are to be inserted, as they would be certain to cause infiltration of urine. Urine soon ceases to escape from the opening, and the wound closes spontaneously.



Fig. 716.

Same as Fig. 715. Showing Perineal Incision, Forefinger Guiding Bistoury to Staff for Bladder Incision.—Macdonald.

Some of the accidents and complications that attend the operation are hemorrhage, failure to enter the bladder, injury to the bladder by the end of the staff or the point of the knife, incision of the rectum, elevation of the bladder by an enlarged prostate till it cannot be reached by the finger, undue rigidity of the neck of the bladder, and encystment of the stone. These accidents are to be avoided by proper care, and the complications variously met. When the stone cannot be reached by the finger the forceps may be passed along the groove of the staff—the pre-

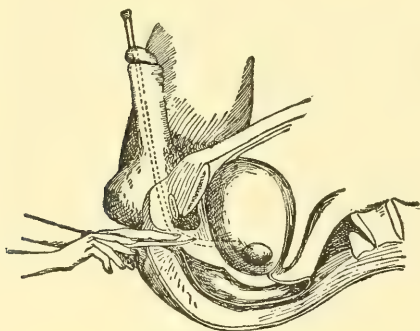


Fig. 717.

Sectional View of Pelvis in Operation.

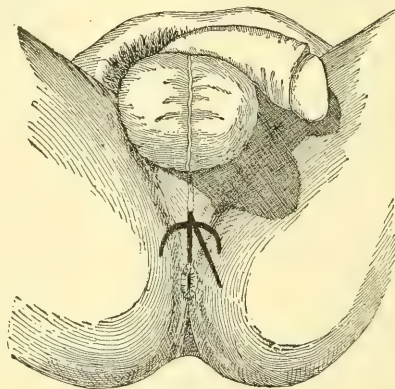


Fig. 718.

Lines of Incision, Lateral, Median and Crescentic Operations.

ferable method in children. When the neck of the bladder is not distensible the stone may be crushed and removed piecemeal. When the stone is encysted it may be dislodged by the finger, scoop or forceps; or, to make it more accessible, a supra-pubic incision may be made.

BILATERAL OPERATION. For the extraction of large stones a crescentic incision through the perineum and bilateral section of the prostate was formerly made, but the supra-pubic method has superseded it.

MEDIAN OPERATION. This affords less room than the lateral operation, but is suitable for the removal of small stone complicated by stricture of the membranous urethra. It is done by cutting down into the groove of the staff in the median line just in front of the anus,

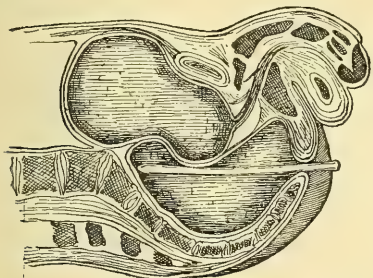


Fig. 719.

Sectional View of Pelvis and Abdomen
Showing Distension of Bladder
and Rectum.

dividing the strictured portion of the urethra and incising the prostate medially or laterally, unless it can be sufficiently dilated to extract the stone without. The left forefinger at the apex of the prostate in the rectum enables the incision to be more definitely made. In anything like normal condition the prostatic urethra admits of sufficient dilatation to allow the introduction of forceps and the extraction of a small stone. When that can be done the cutting operation is only that of external urethrotomy, and involves much less

risk than any other method of lithotomy.

SUPRA-PUBIC LITHOTOMY. This operation, (Fig. 720), does not entail hemorrhage or injury to the neck of the bladder, with its possible causation of sterility, stricture, incontinence of urine or fistula. As formerly practiced mortality was higher by it than by the low operations, but improved methods have brought about better results and a greater popularity. It is specially indicated by large stone and is contra-indicated by deep urethral complication requiring incision.

Preparatory Treatment. For some days previous to operation the bladder should be cleansed, its capacity noted and increased by distension, and, finally, the pubis shaved and the bowels emptied.

Operation. First; an empty rubber bag is oiled and inserted into the rectum, the bladder is injected with eight or ten ozs. of warm boric acid water, an elastic band placed around the penis, and the rectal bag distended till the bladder has been sufficiently elevated above the pubis. (Fig. 719). Some distend the bladder with air claiming that it rises much higher by this means. Second; a median incision, about two and one-half inches long, is made above the pubis, and carefully deepened till the bladder is exposed, care being taken not to open the peritoneum. Some operators introduce a steel sound or a sonde-a-darde to elevate and definitely indicate the point for incision.



Fig. 720.

Supra-Pubic Lithotomy.—Macdonald.

A guy-rope of silk or sheep-gut is inserted into the bladder at the upper end of the incision, a knife plunged in, the opening enlarged so as to permit the introduction of a finger and the extraction of the stone by it or by forceps. A portion of the water is allowed to escape from the rectal bag, and the interior of the bladder and entrance to the urethra

carefully examined, and other needed treatment applied. The treatment of the incision should vary with the circumstances. In young persons, or when the bladder is in a reasonably healthy condition, the bladder incision should be closed by a continuous sheep-gut suture, not penetrating the mucous membrane, and the overlying parts joined by interrupted silk-

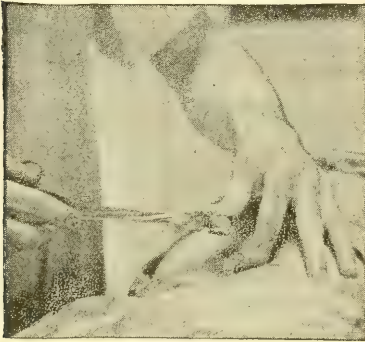


Fig. 721.
Removing Calculus by Supra-Pubic
Route.—Macdonald



Fig. 722.
Supra-Pubic Lithotomy—Drainage Tube in
Bladder, Wound Packed.
—Macdonald.

worm sutures, except at the lower end, where a small drainage tube is inserted to guard against urinary infiltration. Stitching the bladder to the abdominal wall at the upper end of the incision by means of one of

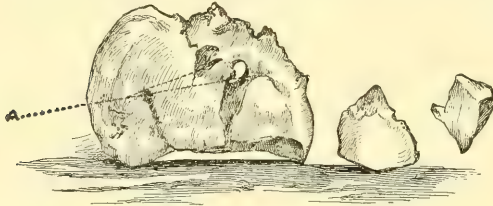


Fig. 723.
Prostatic Calculus—Natural Size. A, Channels
through which Urine passed.—Chislett.

the abdominal sutures passed deeply prevents its descent and lessens the liability to urinary infiltration. In badly diseased conditions of the bladder it is best to leave the incision open except for partial closure of the external wound. Proper healing is promoted by the retention of a large soft catheter in the urethra and a thorough irrigation through and through, with warm boric acid and Thiersch's solution. If there is much cystitis the irrigation should be repeated four or five times in twenty-four hours. If the wound is left open the bladder should be stitched to the overlying structures on each side, in order to prevent lodgment and infiltration of urine within the cavum Retzu.

SECTION XXV.

SURGERY OF THE LOWER ORIFICES OF THE BODY.

CHAPTER I.

CONSIDERATION OF RECTAL DISEASES.

Basic Principles.—In surgery of the outlets two truths must be borne in mind: first, that the general principles of surgery upon which all successful practice is based are applicable here as in other parts of the body; second, that operative interference at the lower openings exercises a specific effect upon the capillary circulation and consequently upon the functions and nutrition of the organism.

In view of the general action of all forms of surgical interference at the lower openings of the body it will be well to consider their surgical necessities, first, from a local and, secondly, from a general standpoint.

Cases suffering from local difficulties are those who enjoy a reasonable degree of general health but who present some form of local pathology sufficiently distressing to demand surgical attention.

Local affections of the rectum will first be considered, and afterward those connected with the male and female sexual systems.

The various operations described in the present chapters, though mostly new, have in every instance been put to oft-repeated and thorough practical tests, thus justifying their introduction into surgical literature as substitutes for older methods. Doubtless they will be improved upon in time and perhaps in turn be discarded.

The rectal diseases to be considered are: first, hemorrhoids; second, prolapsus recti; third, fistulæ; fourth, ulcers; fifth, fissures; sixth, carcinomata; seventh, strictures; eighth, pockets and papillæ.

Hemorrhoids.—Omitting an anatomical description, for convenient reference let those appearing outside the anus be recognized as external hemorrhoids, those appearing between the two sphincters as middle hemorrhoids, and those presenting above the internal sphincter as internal hemorrhoids. Any one of these varieties of hemorrhoids may be either acute or chronic.

EXTERNAL HEMORRHOIDS. Internal and middle hemorrhoids may be prolapsed and present at the anus as a variable-sized cluster of rounded protuberances, of a deep purple color at the circumference, inclining to scarlet in the centre. They are reducible and are not properly classed as external hemorrhoids. These latter are merely those which are irreducible. They are sometimes plump, well-rounded masses of enlarged veins, but more frequently are shriveled and flabby. The so-called tabs or shreds of hypertrophied skin which are to be found dangling at the anus are the remains of previously existing external hemorrhoids or mere bits of hypertrophied integument.

INTERNAL HEMORRHOIDS. These are rounded in form, varying in size from a small pea to an English walnut, and in number from one to half a dozen, clinging to the mucous membrane by sessile attachment between the external and internal sphincters. Their color is red or purple, according as they are active or passive; in other words, as they consist of dilated arterioles or veinlets. Well-marked depressions between these enlargements commonly mark their boundary lines. Internal hemorrhoids are similar in formation to middle hemorrhoids, but project from the surface of the mucous membrane above the location of the internal sphincter. Their lateral margins are not always well defined, and they frequently appear as a continuous enlargement around the entire circumference of the rectum. Their lower extremities are more or less well-rounded and pendulous. Above they slope gradually to the level of the mucous membrane.

The so-called bleeding piles may be either of the middle or internal variety.

ACUTE HEMORRHOIDS. These are usually of the external variety. When hemorrhoids are inflamed, regardless of their variety, they constitute acute hemorrhoids. Otherwise they are considered chronic, although they may vary considerably in size in the same individual at different times. If an acute hemorrhoid be laid open it will disclose the presence of a blood clot, which may have formed within the enclosure of the dilated coats of a veinlet, or, more frequently, be seen to consist of an hematocoele resulting from the rupture of a blood vessel into the areolar tissue.

Etiology. Acute hemorrhoids of the external variety are frequently induced by the bruising caused by the passage of unusual-sized and hardened feces, followed by an undue grip of the external sphincter.

Acute hemorrhoids of the middle variety may be induced in a similar manner by natural processes, or may result from an effort at cure of a chronic condition by the injection method, the gripping of the internal sphincter in either case favoring their formation.

Acute hemorrhoids of the internal variety have similar causes, except that they usually occur in cases of prolapsus, and the contraction which aids in inducing the condition is accomplished by contraction of the external sphincter.

Treatment of Acute Hemorrhoids. Rest in bed and treatment by fomentations and medicated suppositories will nearly always remove the inflammatory symptoms of acute hemorrhoids in the course of a few days. A simpler and more satisfactory manner of handling them, however, is to slit them open carefully with a sharp-pointed curved bistoury and then with a spud to evacuate the clot which they contain. With acute hemorrhoids of the external variety this requires no speculum and is not extremely painful, nor does it confine the patient. Acute hemorrhoids of the middle and internal varieties may be treated in the same manner through the expanded blades of a small speculum, if the parts are not hyperesthetic. If the process promises to be at all severe the case should be treated under an anesthetic, at which time the sphincter should be dilated and whatever other rectal work is needed should be performed. A few hours of fomentations and a few days in bed are necessitated.

Treatment of Chronic Hemorrhoids. Chronic external hemorrhoids in all stages of their development, from well-rounded tumors to

tabs, can be properly treated only under a general anesthetic or hypodermic injection of cocaine. They are not sources of much annoyance or harm to the patient, except when accompanied by pruritis ani. It is, therefore, not necessary to interfere with them unless for other reasons it is necessary to anesthetize the patient. They are seldom found, however, except when accompanied by hemorrhoids of the middle or internal variety, and consequently can be removed should the patient be anesthetized for the treatment of these conditions. They are to be snipped away in such a manner that the anus will heal smoothly. No danger of hemorrhage need be feared, they are seldom engorged, and should the wound show a tendency to bleed hemorrhage can quickly be controlled by torsion. Fomentations applied for a few hours after the operation will prevent subsequent hemorrhage and soreness.



Fig. 724.

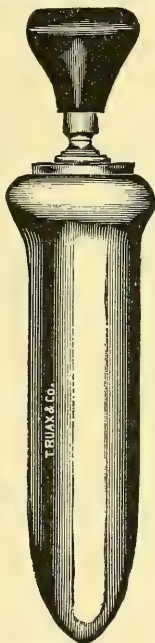


Fig. 725.

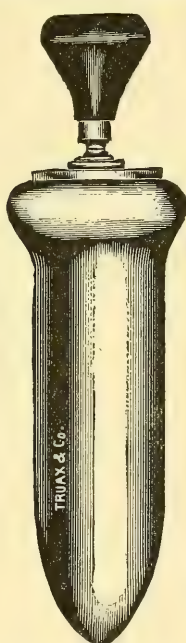


Fig. 726.

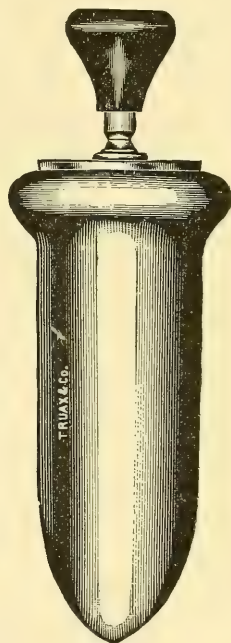


Fig. 727.

Author's set of Rectal Plugs.

Rectal Plugs. Chronic hemorrhoids of the middle and internal variety manifest their existence and induce the patient to apply to the surgeon for relief because they occasion pruritis ani or hemorrhage, or are prone to prolapsus at stool. Pruritis and bleeding are fully as apt to be occasioned by small hemorrhoids as by large ones, and in many cases a single small hemorrhoid may prove to be the sole cause of discomfort. The simplest means should always be employed first, to be followed by more radical measures in case of their failure to give relief. One of the simplest, most successful and satisfactory ways to treat such cases is to provide them with a set of graded dilators or plugs. Of these there are now many forms on the market, varying in shape and material. They can be constructed of aluminum, hard rubber, glass, wood, or nickel-plated brass, and are made egg shaped, straight or bulbous. Figs. 724-727 illustrate a set of four graded rectal plugs of the straight variety and constructed of nickel-plated

brass, which, perhaps, are as serviceable and useful as any. As it is better to employ them at bedtime the patient can be furnished with them to use under direction. The smallest size, No. 1, will be needed with children and in extreme cases of anal contraction and sensitiveness. Most patients can begin with No. 2. The size selected should be smeared with vaseline and inserted as far as its shoulder, the patient lying upon either side, as the instrument is self-retaining except in the rare cases in which it induces tenesmus. It should be retained from five minutes to an hour or more each time. As a rule it is not wise to use the rectal plugs oftener than twice a week, and in hyperesthetic cases once a week may be all that is required. But where the parts are anesthetic, the hemorrhoids large, the redundant tissue abundant and reactive powers poor, the plugs may be used daily for a time and for half an hour or even longer at a treatment. Even aggravated cases of all varieties of hemorrhoids have been cured by these plugs. The plugs have also a deeper action than a merely local one, stimulating peristaltic action, thus frequently and materially aiding in the cure of constipation, and being useful, in addition, in other and more general affections, to which attention will be directed later on. If they are employed too long and too frequently they are liable to produce both local aggravation and more or less general disturbance of the system; the hemorrhoidal condition may be aggravated and the anus made irritable, or the plugs may induce spinal congestion, and disturb the sexual and urinary apparatus. They must be used, therefore, with judgment, and the length of time they are permitted to remain inserted and the frequency of the treatment are questions to be determined by the reactive powers of the patient alone. No rule can be laid down except to adapt their employment to each case separately as its needs may require. It is always safe to employ the plugs to the point of some form of reaction, manifesting itself either in a general disturbance of the system, in increased, or possibly diminished, peristaltic action, or sexual or bladder disturbance. Cases in which they afford only partial relief, those in too irritable a state to permit of their employment, and those in which are required quicker and more complete results than can be obtained by their aid, demand some form of operative procedure.

Injection Method. The use of the hypodermic syringe or what is known as the injection method of treating hemorrhoids has been rather freely employed by the medical profession for a number of years, but is now passing gradually into disfavor, being displaced by other and better methods. The main arguments which established the process and secured its brief term of popularity are that the treatment is comparatively painless, and that it does not confine the patient, permitting him to pursue his usual daily habits of activity. The arguments which have induced physicians to abandon the process are: First, that the treatment is not applicable to external hemorrhoids; second, that only two or three hemorrhoids can be treated at a sitting; third, that the sittings must be one or two weeks apart so as to avoid inducing inflammation; fourth, for the cure of an extensive case of hemorrhoids several months' treatment is required, which, if the patient comes from a distance, renders it impracticable; fifth, the treatment frequently induces inflammation and results in abscesses and ulcerations, which are not only extremely painful but sometimes dangerous, necessitating in the end some other form

of treatment; and sixth, it does not relieve undue tension of the sphincters nor satisfactorily relieve aggravated cases of redundancy. At best, therefore, its sphere of usefulness is quite limited. Many cures are reported by those who prefer this method of treatment, but the author is persuaded that the cure is as much due to the dilatation involved in passing the speculum as to the injection employed, such cases being fortunate enough to escape excessive inflammatory action.

As the injection method, however, is still in favor with some it may be well to treat briefly of its method of application. An ordinary hypodermic syringe with a long needle and some form of rectal speculum are the instruments required. There is no speculum quite so well adapted to this form of treatment as the original Brinkerhoffer slide speculum. The instrument is inserted well into the rectum and the slide is withdrawn. By careful manipulation the hemorrhoidal tissue may be made to appear in the limited field exposed. Hemorrhoidal tissue may be distinguished from mere hypertrophy by the facts that it is of a deep purple color and bleeds easily when pricked. The hypodermic syringe, charged with the fluid to be injected, is now to be thrust well into a pile tumor and a few drops of the solution injected. When abscess or sloughing results it is usually because too much of the injection fluid has been employed.

From two to four drops are sufficient for an injection. Upon receiving the injection the pile tumor immediately assumes a pale white color. The important point in a speculum for this purpose is that the hemorrhoids must be completely surrounded by circular pressure about its base in order to prevent thrombi. Where it is impossible to procure the slide speculum men-



Fig. 728.
Sim's Median Speculum.

tioned a bivalve speculum or Sim's small vaginal speculum will answer the purpose (Fig. 728), provided the hemorrhoid be ensnared in the grip of a circular retractor while the injection is being used. A favorite injection fluid consists of equal parts of carbolic acid and sweet oil mixed, when the oil is cooled to a few degrees below the freezing point and subsequently heated. Another good injection consists of equal parts of calendula, glycerine and carbolic acid. Still another, and perhaps the best of all, consists of carbolic acid and glycerine, each two fluid drachms, fluid extract of ergot one drachm, water one-half drachm, mixed.

If this method of treatment took away the redundant mucous membrane and was not so tedious it would be more desirable. It is much more satisfactory, however, to handle a rectum upon sound surgical principles than to temporize with it, and, therefore, the injection method is rapidly passing into disfavor.

Ligation. The treatment of hemorrhoids by ligature is unscientific and should be abandoned. It was devised before practical rectal speculums could be procured and before satisfactory methods of exposing rectal tissues were known. It calls for an expression as to its demerits in this connection because its practice is still in vogue with some rectal sur-

geons and spoken of with favor, not only in text-books but in current literature. The process is so cruel, so unsurgical, and so wholly unnecessary that its discontinuance will soon be demanded by all progressive and intelligent operators. It is merely a brutal way of securing the amputation of a diseased part by strangulation. It impinges nerves, induces sloughs, causes unnecessary shock, and invites secondary hemorrhage. Surgeons who practice it have little appreciation of the profound action upon the respiration and capillary circulation caused by pinching the anal tissues or they would not so readily consent to strangle the terminal nerve fibres of the anus with unyielding ligatures. Numbers of patients have been killed by this process upon the operating table, their death being ascribed to the effect of the anesthetic, when in reality it was due solely to nerve impingement. The surgeon who would suggest the removal of a limb by strangulation would be universally condemned, and there is no reason why the removal of a hemorrhoid should not be secured upon as sound surgical principles as are demanded in the amputation of other offending portions of the body. The process will not be described because it is not deemed worthy of such recognition in the pages of a modern text-book.

MEDICATION. Acute hemorrhoids sometimes cause intense pain and may require the exhibition of aconite, belladonna, arnica, chamomilla, gelsemium or ferrum, depending upon the condition present. In chronic hemorrhoidal subjects in whom acute hemorrhoidal inflammation suddenly develops nux vomica and sulphur, singly, may be demanded. If the piles are swollen, congested, blue and painful *carbo vegetabilis* will often relieve. Belladonna is also called for by the foregoing symptoms when the case is recent, *carbo* following well after a few hours if belladonna fails to relieve.

Esculus is especially to be thought of with acute hemorrhoids; there is dragging pain in the lumbar region, especially in women, and not infrequently an application of this remedy, either in the form of a cerate or an aqueous lotion, will be beneficial. *Hamamelis* is also valuable in this relation, while *calendula* is soothing with some subjects. Aloe, internally, is also a valuable agent, and *sepia*, *podophyllum* and *bryonia* will be needed in individual cases. *Plumbum* and *bryonia* are especially applicable when constipation is severe.

CHAPTER II.

PREPARATION OF PATIENT.

Principal Considerations.—The previous use of rectal plugs, as described in Chapter I, for a few weeks, is desirable but by no means indispensable. Its advantages are that it reduces the size of the hemorrhoids, improves the tonicity and consequently the healing power of the anal mucous membrane, accustoms the patient to the systemic effect of anal dilatation, and thus lessens the general disturbance of the system. Where this is impracticable, however, a few days may be profitably spent in thoroughly emptying and cleaning the colon. For this purpose purgatives are to be neither universally condemned nor employed, the habits and individual peculiarities of the patient determining this point. In all cases, however, it is well to employ thorough colon flushing once or oftener before the operation is undertaken.

COLON FLUSHING. The patient is to assume the Sims position upon the right side, lying across the bed so that the buttocks may extend just beyond its margin, which is to be protected by a Kelley Apron (Fig. 729), the lower margin of the apron being received into a slop pail or pan. A French soft-rubber, olive-tipped, hollow bougie (Fig. 743), is to be well smeared with vaseline and introduced into the rectum, the tip of an Alpha, or some other bulb syringe capable of throwing a continuous stream, is inserted into the bougie, and the injection is forced into the rectum. As the water is thrown into the bowel it will proceed readily along the entire length of the intestine, unless it encounters some obstruction, or until the distension induces an effort at expulsion.

Should it show a tendency to escape by the side of the bougie this should be wrapped with a towel, and held snugly against the anus. Hydraulic pressure will soon carry the injection beyond the obstruction by overcoming the expulsive effort of the colon, and it will then find its way to the cecum.

A gallon or more of the injection-fluid can be employed in this manner, and the colon thoroughly washed out.

As soon as the entire colon is thoroughly filled, which can usually be ascertained by the sensations of the patient, and always by palpation, the anus can be curtained with a towel and the fluid be permitted to escape. Where the peristaltic action is too weak to secure this a small sigmoid speculum (Fig. 742) can be inserted as far as the sigmoid flexure of the colon and be carefully dilated as it is withdrawn. Where the patient has good control of the anus and is able to retain the injection until he can assume the upright position it may be passed in a commode. As soon as the injection has been expelled the process should be immediately



Fig. 729. Kelly's Small Apron.

repeated to secure a more thorough evacuation of the contents of the colon. Sometimes, where the patient is sufficiently vigorous, three flushings at a sitting are desirable. The first one or two may be made of soapsuds containing salt in the proportion of a teaspoonful to a quart, but the last one had better be of plain water so as not to leave the soap in the bowel, as in some cases it induces irritation. This treatment should be repeated once in two or three days until the colon is entirely cleared of fecal matter and all its emanations are inoffensive. Between the times of flushings one or two small enemata of plain water may be employed once or twice daily, the patient being urged to secure their retention if possible. The water thus retained is speedily absorbed and by increasing the quantity of urine serves as a satisfactory bath for the urinary tract. In many cases a thorough enema and single flushing may be all that is needed as preparatory treatment. But the practice of colon flushing previous to all operative procedures upon the rectum is safe and satisfactory.

Bathing.—The question of baths as well as that of flushings must depend somewhat upon the strength of the patient. While water is cleansing it is at the same time enervating, and if the patient is already in a weakened state a few dilatations of the anus a few days apart, with a single flushing one or two days before the operation, are a better preparation than a longer course of colon flushings, with or without baths.

It is better, although not absolutely necessary, to restrict the diet of the patient to liquid food for a few days before an operation is undertaken. A few hours before the operation the patient may indulge in a small amount of some form of liquid nourishment. The question of nausea following an anesthetic is not so dependent upon the contents of the stomach as it is upon the mental attitude of the patient towards its administration. It is a frequent occurrence that patients whose stomachs are entirely empty experience violent and prolonged attacks of nausea and retching, and that others are able to take an anesthetic even upon a full stomach without the slightest discomfort. As the administration of an anesthetic to a patient with a full stomach is a somewhat dangerous proceeding, however, it is never advisable. It is at the same time exceedingly prostrating and fully as apt to produce nausea if administered to one whose stomach has been entirely empty for many hours. For that reason it is well for the patient to partake of a small amount of liquid nourishment a few hours before taking the anesthetic.

Anesthetics.—No radical operation for hemorrhoids should be undertaken without the employment of an anesthetic; however, this subject is discussed elsewhere and requires but brief consideration here. The author's present practice in giving anesthetics is usually to employ a mixture of one part of chloroform to two parts of sulphuric ether. In cases troubled with kidney affection the practice is to employ pure chloroform, and where there is considerable functional derangement of the heart, unaccompanied by weakness of lungs or kidneys, pure ether has been selected. The author has performed hysterectomy under gas anesthesia, but has not yet employed it sufficiently extensively to entitle him to an expression as to its permanent place among anesthetics. Occasional cases will be found, especially those suffering from spinal irritation or sclerosis, which will consume an inordinate amount of anes-

thetics without satisfactory anesthesia being secured. A hypodermic of one-quarter or even one-half grain of morphine in such cases has a very happy effect. Of course a large dose of morphia will not be administered without some knowledge of the patient's tolerance of the drug. In those patients in which even this fails to secure the desired condition the rectal bivalve should be inserted into the rectum and it be carefully but steadily dilated for a few seconds. Like salutary effect is occasionally produced in the male by passing a sound, or in the female by dilating the vagina. The patient, being partially awake, may experience discomfort at the dilatation, but it is sometimes absolutely necessary and is a merciful infliction, saving the absorption and exhibition of an inordinate amount of the anesthetic. If in such obstinate instances the anesthetic be crowded to complete accomplishment of its purpose a large amount of time is lost and too much of the anesthetic is used. But this is not all. When such a patient is placed upon the operating table and the rectal speculum is employed for purposes of dilatation a very dangerous narcosis is almost sure to be induced and fatality is courted. No rule can be laid down for the time for the exhibition of the speculum in such cases; conservative judgment upon the part of the operator is the only reliance for its employment. If the anesthetic be heated by placing the bottle or can which contains it in warm water it will act more quickly and in smaller quantities.

Recently Northrup, Philadelphia, has followed the practice of passing pure oxygen through the chloroform inhaler during administration, with the result that it is claimed that nausea, collapse and other unpleasant symptoms belonging to chloroform narcosis are done away with. The practice has not yet been sufficiently proven to enable the author to express an opinion that would carry weight in relation to this new method, but it seems to have the sanction of reason, and it is believed by its discoverer and others who have resorted to it that it will become a favorite method in chloroform anesthesia.

CHAPTER III.

OPERATIONS FOR HEMORRHOIDS.

Preliminary Considerations.—The patient, having undergone the desired preparatory treatment, is anesthetized and placed upon the operating table in the lithotomy position. An assistant upon either side of the operator is desirable in all operations upon the rectum wherever it is possible, as it is better to have the patient sustained in his position by assistants than by any form of mechanical contrivance. The bichloride bath has been given, antiseptic stockings put on, the thighs have been wrapped in sterilized towels, and the anal and gluteal regions thoroughly shaved. It is important in all cases to precede the operation by the insertion of the index finger for exploratory purposes. If there is no stricture or tumor to contra-indicate the employment of the rectal speculum the large rectal bivalve, as shown in Fig. 730, is to be inserted

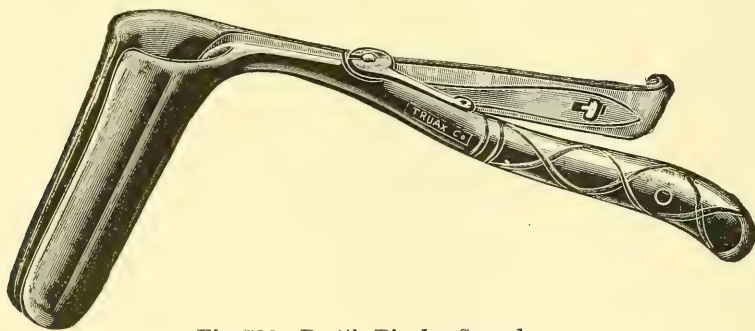


Fig. 730. Pratt's Bivalve Speculum.

into the rectum and the effect upon the patient's respiration noted. In sensitive subjects the mere introduction of the closed speculum is sufficient to completely suspend respiration for the time being. In such cases the anesthetic should be stopped, the instrument immediately removed, the thighs lowered and the patient permitted to recover his breath. As soon as he has regained his equilibrium he can be once more placed in position and the instrument again inserted. This time, in all probability, the speculum may be partially opened before it will be again necessary to remove it. If the second insertion produces a dangerous collapse the operation had better be abandoned for the present and the patient permitted to regain consciousness. A week later he should be again anesthetized, and it will be found that at this second sitting the shock will not be so great and the operation can be proceeded with.

Selection.—There are but four operations for hemorrhoids which seem worthy of consideration, and the method to be selected in a given case will depend, of course, upon the conditions encountered. These are the slit operation, the American operation, and two forms of clamp operation. Where the hemorrhoids are comparatively small and but little redundant

tissue presents itself the operation known as the slit or excision method is preferable. In cases which present from one to three or even four hemorrhoids too formidable in size to be safely treated by the slit operation, and the tissue between seems to be normal both in quantity and quality, the removal of the hemorrhoids by the small clamp is safe, effective, and satisfactory. Where, however, the last inch of the rectum abounds not only in hemorrhoids but in large masses of redundant tissue, so that it prolapses at stool or when the bivalve is inserted, opened and withdrawn, nothing but the removal of the pile-bearing inch is equal to the requirements of the case. This can best be accomplished by what is now known as the American operation, or by the aid of a clamp. The Whitehead, or English operation, is not recommended because the author regards the American operation as its superior.

Slit Operation.—This is accomplished by means of the tenaculum and scissors through the expanded bivalve. The tenaculum (Fig. 731) and also the curved scissors (Fig. 732) will be found well adapted for this work. The scissors are bent at the proper angle to enable the hand which employs them to accomplish its purpose without obstructing the field of operation. The closed bivalve is now to be introduced with the handles downward, and if no unpleasant effect is produced upon respiration the blades may be carefully opened, bringing into view the anterior, or upper, and posterior, or lower, surface of the rectum. It will be found more convenient to operate between the margins of the speculum nearest the handles. If a large sized hemorrhoid be located posteriorly, or, the patient lying in the lithotomy position, below, the extremity of the hemorrhoid nearest the anus is to be seized superficially by the tenaculum and while the assistant is holding the blades of the speculum apart the operator removes a narrow strip of mucous membrane with the scissors, starting at the anus and cutting longitudinally to the intestine as far as the upper border of the hemorrhoid. This will expose to view the sub-mucous areolar tissue, in the meshes of which lie imbedded the small terminal veinlets, the cluster of which, together with the redundancy of the surrounding tissue, constitutes the hemorrhoid. These little terminal veinlets resemble

Fig. 731.
Pratt's Te-
naculum.

very closely the appearance of grape seeds, and as soon as the narrow strip of mucous membrane has been removed from the surface one or more of them usually protrude themselves through the opening. The scissors are now to be partially opened, and in this state are to be pressed against the areolar tissue in such manner that the small venous enlargement will protrude beyond the surface of the blades. The scissors are then closed, and the part of the hemorrhoid in view is to be excised. The areolar tissue is to be carefully cut away with the scissors, and all hemorrhoidal tissue in this way snipped from its areolar bed. A thorough excision of all hemorrhoidal tissue usually makes



Fig. 732.
Hemorrhoidal
Scissors.

it necessary to dissect away the entire mass of areolar tissue and its contents until the fibres of the internal sphincter muscle are exposed. If in accomplishing this an artery of any considerable size is severed it can easily be seized by an artery forceps (Fig. 733) and torsion applied, or the instrument can be left gripping the artery for one or two minutes while the surgeon is going through a similar process upon the lateral and anterior aspects of the rectum. Hemorrhage is most liable to be in-

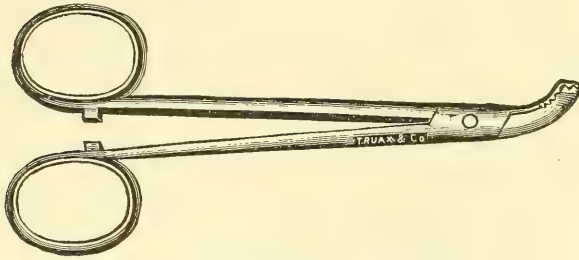


Fig. 733. Pratt's Short Artery Forcep.

duced in front and at the sides. But it is never troublesome, always easily controlled, and in the majority of cases it is not even necessary to use an artery forcep. As soon as the excision of the lower hemorrhoid is complete the speculum should be removed—

especially in cases where dilatation seems to affect the respiration profoundly—and introduced at right angles to the previous incision so as to bring the lateral margins of the lower rectum well into view. The bivalve speculum is provided with a set-screw in the handles so that the instrument can be held in an expanded condition without the aid of an assistant. This screw is by no means a desirable part of the instrument and had better be removed from it, as it is never safe to leave the dilated speculum in the rectum long at a time. At all operations the surgeon should have sufficient assistance to have the aid of at least one pair of hands and one of the hands can always be employed in retaining the speculum in proper position. As soon as the lateral margins of the rectum have been cleared of all hemorrhoidal tissue by the aid of the tenaculum and scissors the upper or anterior part is to be treated in the same manner.

SPECIFIC POINTS. Six points are to be especially observed in this operation: First, all slits should be made as far outward as the lower margin of the anus. The work must be thorough. All the enlarged terminal veinlets are to be excised.

Second. Care must be taken to leave at least three or four strips of mucous membrane between the incisions which must not be molested. If these strips cover hemorrhoids the hemorrhoids must be excised underneath them. It matters not how narrow these strips may be, nor how much of the mucous membrane be removed from the surface of the rectum provided these strips are left intact, as the reparative power of the lower rectum is very remarkable and the membrane seems to so thoroughly reproduce itself that if only small portions of it are left unmolested they will grow laterally and cover the denuded surfaces in a very satisfactory manner without the formation of strictures, and apparently without the formation of any considerable amount of cicatricial tissue. Some months after performing the slit operation it is impossible to tell that the rectum has even been wounded, so complete seems to be the reproduction of the mucous membrane.

Third. It is well to have the hemorrhage thoroughly controlled before the operator leaves the case.

Fourth. Thorough dilatation of the anus should be practiced after the cutting is done, because if it is employed beforehand it bruises the tissue, causes hematoceles, and the swelling which results obscures the tissues and increases the difficulty of the operation.

Fifth. Throughout the operation the operator must watch the respiration, as in sensitive subjects it will be found necessary to remove the speculum frequently and suspend the operation at intervals for a few seconds to permit the patient to sustain the shock of the work. The operator must remember that he is dealing with the sympathetic nerve, upon which life depends, as well as with the cerebro-spinal system.

Sixth. The slit operation should always be followed by the application of fomentations to the anus for at least three hours. The cloth for this purpose should be flannel, and it is well to medicate the water with the extract of hamamelis.

CIRCUMSCRIPTION. The slit operation is to be confined to hemorrhoids of the middle and external variety, great care being taken never to wound the mucous membrane above the internal sphincter. As soon as the operation has been completed and all objectionable tissue has been removed the rectum should be carefully dilated, not by suddenly opening the blades of the speculum but by expanding them intermittently until a desirable degree of dilatation has been accomplished. The capacity of the speculum marks this point in the majority of cases. Occasionally it will be necessary to practice a more thorough dilatation than can be secured by the speculum, which can be done by the first and second fingers of the hands, inserted back to back, and spread at the discretion of the operator. Cases will also be found in which dilatation to the full capacity of the speculum will prove to be too excessive, as it would result in laceration of the sphincter muscles.

Excision of middle hemorrhoids has for generations been the ideal method of operation, its only objection being the danger of hemorrhage. Surgeons have encountered hemorrhage and have been unable to satisfactorily control it for two reasons; first, the lack of proper instruments with which to manipulate rectal tissues, and, second, the absence of a proper method of exposing the tissues. The invention of the bivalve speculum and "T" forceps has most thoroughly removed these two objections, and the proceeding is no longer either in the least degree formidable or dangerous. As a rule,

hemorrhage of any considerable degree is seldom encountered, and if it is the tissues, by the aid of the speculum and "T" forcep (Figs. 734 and 735), are

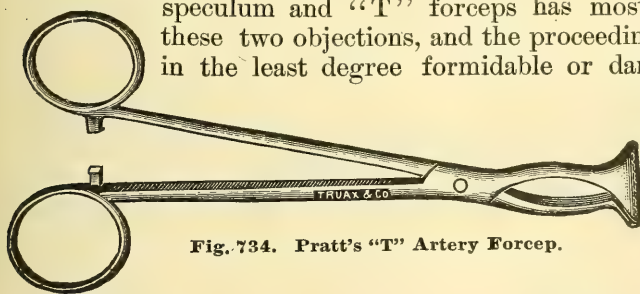


Fig. 734. Pratt's "T" Artery Forcep.

placed so completely under the control of the operator that artery forceps can readily be applied in any instance, and they are thoroughly adequate to every possible occasion.

After the complete circle of the anus has been made in this manner and all the hemorrhoids have been excised and dilatation accomplished it is well to place a plug, constructed of antiseptically prepared China

silk enfolded a small wad of absorbent cotton, in the rectum and leave it there for from fifteen or twenty minutes to an hour or two according to the necessities of the case. The patient must be carefully watched while the plug is retained, and should his breathing or circulation be

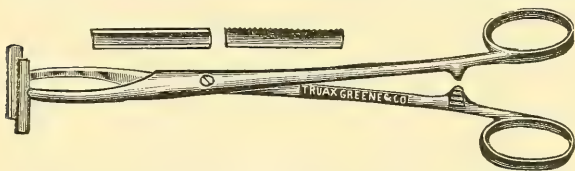


Fig. 735. Smith's Modification of Pratt's "T" Forcep.

seriously disturbed by it it is to be at once removed and fomentations applied.

Although the operation may appear in some instances as quite a

severe one it is not so, and after the first few hours the patient is usually entirely comfortable, experiencing no pain whatever until three or four days later when the first action from the bowels is secured. Even this can be rendered painless if the instructions given later on are followed.

After all middle hemorrhoids have been excised in the manner described the anus is to be carefully trimmed of all tabs and external hemorrhoids. No instruction is necessary for this work other than the direction to cut them away even with the surface of the anus. This is an almost bloodless proceeding and needs no further comment.

Where the middle hemorrhoids are but few in number and so extravagant in size as to render their removal by excision unadvisable it is a simple matter to remove them by either Linn's or Eldridge's straight clamp. If Linn's clamp is selected the instrument is to be applied longitudinally and the hemorrhoids excised by a pair of scissors close to the outer surface of the clamp. The clamp is to be left in position for two or three minutes, after which it can be removed. No hemorrhage will follow. The application of the cautery, which is the practice of some, is entirely unnecessary. The Eldridge clamp (Fig. 736) has one advantage over the Linn clamp. While it crushes the stump of the hemorrhoid and prevents hemorrhage equally with Linn's it at the same time performs the act of amputation and saves the employment of the scissors.

The danger of handling internal hemorrhoids or those located above the internal sphincter by the slit method lies in the fact that the surface which supports them is not within the grip of the sphincters and, consequently, the hemorrhage at this point is not so easily controlled and is more liable to recur, especially



Fig. 736. Eldridge's Pile Clamp.

during vomiting and straining at stool, when the whole rectum can fill with blood and patients bleed to a dangerous point before the trouble is recognized. If this point is borne in mind and care is taken to thoroughly secure all bleeding points by means of torsion or ligature at the time of the operation the slit method is just as applicable to internal hemorrhoids as it is to middle and external. It is frequently necessary in all surgical operations to ligate arteries, but that is no excuse for unnecessarily ligating masses of tissue thickly

supplied with nerves. The location of internal hemorrhoids is perfectly accessible, and all hemorrhage from whatever operation can be controlled here as perfectly as it can be in an amputated limb. There is no more excuse for ligating a hemorrhoid with all its plexuses of nerves than there is in performing amputation of any other part of the body by the sloughing process.

Some prefer the use of clamps in this locality also, and the only objection to their use is the bruising of the tissues, which, while it stops the hemorrhage, adds to the shock. They do not occasion sloughing.

What has been described as the slit operation, although identical in its result with what has been for many years recognized as the operation of excision, varies from it somewhat in the details of its execution, the difference being that in the slit operation only a narrow slit is made in the mucous membrane, and the hemorrhoid, which consists of a large number of dilated venous terminals resembling grape-seeds, is dissected away by piecemeal and in a majority of instances almost without hemorrhage; whereas in the old operation of excision the entire hemorrhoid is clipped away *en masse*, thus increasing the hemorrhage and consequently the difficulty of the operation. Most of the prominent authors upon hemorrhoids, especially of the generation immediately preceding the present one, speak of excision as the ideal method of exterminating hemorrhoids but for one reason—that of hemorrhage. The recent invention of satisfactory rectal specula, the “T” and improved artery forceps, and the advance in methods of rectal exploration and exposure have completely removed this objection and placed hemorrhage of the last inch of the rectum as thoroughly under the control of the surgeon as it is in any other part of the body; and, consequently, in the removal of single hemorrhoids, regardless of their size, excision now stands as the most scientific and satisfactory means for their extermination.

There are many cases, however, in which the hemorrhoidal protuberances are so extravagant in their development and so numerous, where the rectal tissue is so hyperplastic and redundant, where the whole last inch abounds in such a mass of redundant, protruding, prolapsing, disorganized tissue that nothing but a complete extermination of the mucous membrane covering the lower portion of the rectum will afford satisfactory results from operative procedure.

There are two ways of accomplishing this; one by the clamp method, and the other by the American operation. The clamp operation will be preferred by many, as amputation of the last inch of the rectum by this method requires less skill than the successful performance of the American operation. The clamp operation can be made almost entirely bloodless, while this is not so easy of accomplishment in the performance of the other. The results of the clamp operation and the American are both satisfactory, although the American operation well performed is superior to the clamp, even when it is well performed.

Clamp Operation.—In performing this operation by far the most satisfactory instrument is the curved form of Linn’s clamp (Fig. 737). The various steps of the operation are as follows: After the patient has been placed in the lithotomy position the rectum is first to be dilated by the aid of the rectal bivalve and the sigmoid thoroughly cleansed with the assistance of a sigmoid speculum. (Fig. 742). The dilatation should be slowly

accomplished so as to avoid rupturing the sphincter muscles. The hemorrhoidal mass to be removed will now appear protruding from the anus and varying in size from an English walnut to a large navel orange. "T" forceps varying in number from half a dozen to a dozen are to be applied in a circle, seizing the hemorrhoidal tumors at their summits, and as the instruments are held in diverging directions by an assistant on each side

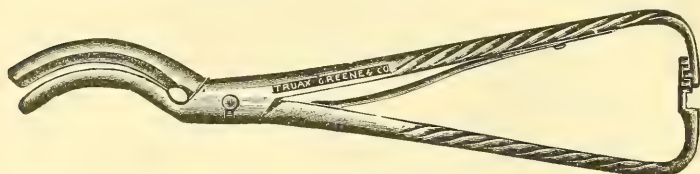


Fig. 737. Linn's Pile Clamp.

the operator can always observe that the lower extremity of the protruding tissue is uneven in its outline. He

will find three, and frequently four points about the circle which seem to be devoid of hemorrhoidal tissue and appear as small valleys between adjacent hemorrhoidal hills. These depressions in the encircling ring are to be transfixed and severed with a bistoury in lines diverging from the centre of the anus like spokes in a wheel, until the bottom of the cut is on a level with the skin covering the ischio-rectal fossa. This wound will expose the lower fibres of the external sphincter muscle but not injure them. The cuts will almost invariably be located laterally, as it is very seldom that a depression between hemorrhoidal masses is found either directly in front of or behind the anus. If the depressions have been three in number they will divide the hemorrhoidal rim into three segments, two lateral and one anterior. If there have been four, one segment will be located anteriorly, one posteriorly, and two laterally. The lateral segments should be removed first and in the following manner: One or more "T" forceps are already gripping the centre of the tumor. Others should now be applied in the centre of the hemorrhoidal segment close to the wounded margins. Three or four "T" forceps are now applied to the tissue to be removed and are to be held by an assistant in the direction of the continuation of the body of the patient, sufficient traction being employed to thoroughly straighten the tissues but not to put them upon a strain. Linn's curved clamp is now to be applied to the hemorrhoidal segment in such manner that its greater curve rests gently and evenly against the integument. The anesthetic is to be stopped, for in many cases as soon as the instrument is tightened the impingement of the hemorrhoidal tissue will induce complete suspension of respiration. While this is not always the case the circumstance occurs with sufficient frequency to demand that the surgeon be ever upon his guard, watching the patient at this point with extreme care. When the clamp is tightly closed so that the tissue is firmly squeezed within its jaws, if the respiration be suspended the blades must be immediately loosened and sufficient time allowed the patient in which to regain breath. If the respiration continues undisturbed the anesthetic can be continued, and while the clamp is well tightened the "T" forceps can be removed and the excess of tissue amputated close to the outer surface of the clamp. A straight needle threaded with heavy silk must now pierce the rectal tissues beyond the clamp but in close proximity to it in three or four places, and in directions diverging in straight lines from the

centre of the anus. The extremities of these silk sutures are to be held by an assistant, the clamp removed, and the crushed tissue clipped away with scissors, care being taken not to remove all of it, as this would induce hemorrhage. The silk ligatures are tightened and the other segments of the hemorrhoidal tissue are treated in the same manner. The last one to be treated should be the anterior one, because when the clamp is tightened upon this segment it seems to produce a more profound effect upon the respiration than is caused by the pinching of other portions of the rectum and the severe shock had better be reserved to the last for two reasons; first, the shock will not be so severe as if it had been seized in the beginning of the operation, previous shocks accustoming the system somewhat to the proceeding and the pinching of the more sensitive part at the last will, consequently, not be so severely felt, and, secondly, the effect of pinching the anterior segment is sometimes so profound that the vitality of the patient is considerably lowered for the time being and it would be unwise to keep him under an anesthetic for a prolonged period after its occurrence. After the silk ligatures have been tied they should all be left long, as they are to be employed as guys. A continuous suture of sheep-gut is to be applied around the entire circumference of the anus, bringing the severed margins of the skin and mucous membrane carefully together. The silk ligatures are then to be removed and the operation is complete. The parts are to be dusted with iodoform, quinine, iodol, or some other form of antiseptic dry dressing. A perineal pad covered with silk is to be applied to the anus and held in position by a "T" bandage, when the patient is to be placed in bed.

As the after-treatment of the clamp operation is identical with that of the American reference to it will be deferred.

American Operation.—The American operation, first performed by the author in November, 1889, is a method of renewing the mucous membrane of the last inch of the rectum, taking away the worn out, thread-bare lining of the part and replacing it by a new piece of membrane brought down from above, leaving, as a result of the work, only a small circular wound whose margins are held together by a continuous suture placed at the margin of the anus.

OPERATIVE TECHNIQUE. After the anus has been dilated and the rectum and sigmoid cleared of fecal matter by the aid of the sigmoid speculum and douche, as mentioned in speaking of the clamp operation, the sigmoid speculum is to be again inserted and through its diverging blades is to be carried, by means of Hall's sigmoid forceps, a long wool tampon. The protruding mass of hemorrhoids is to be seized by "T" forceps applied in a circle as in the clamp operation, and assistants are to seize the instruments and hold them in diverging directions so as to bring the parts well into view. There is a well marked line circumscribing the mucous membrane lining the lower part of the rectum, which should be sought for. This line marks the junction of the middle and lower rectum and is always well defined. In cases of hypertrophied tissue, such as are being considered, the direction of this line is not circular, but presents three or four points in its course which are located a little higher in the rectum and appear to be a little more fixed than the other parts of the line. Where there are three such points two of them will be found located laterally, toward the perineum, while the remaining

one will be immediately in front of the coccyx. Where there are four of these depressed points two will be found in front as before, the other two being located laterally toward the coccyx. The mucous membrane of the rectum is seized by the "T" forceps at these points of depression, and while the assistants are holding them in such position as to make the mucous membrane between the points of attachment tense other forceps are made to seize the straightened margin of intervening tissue in such manner and in such close proximity to each other that the mucous membrane is grasped by a line of "T" forceps proceeding in a symmetrical circle around the entire circumference of the intestine and just above the line of demarcation mentioned. All these forceps, which will vary in number from eight to a dozen, are to be held in symmetrically diverging directions by the assistants. The operator should then grasp in his left hand the forcep immediately in front of the coccyx, and while he is employing gentle traction upon it the index finger of the same hand, passed outside of the protruding hemorrhoids, will enable him to locate the external sphincter muscle, which will appear as a well defined circular enlargement just above the hemorrhoidal tumors. One blade of a sharp-pointed pair of scissors slightly curved at their points is now to pierce the mucous membrane just above the grasp of the pair of forceps in the hand of the operator, and be made to puncture the tissues until the operator can feel the point of the imbedded blade of the scissors between the end of his index finger and the sphincter muscle. As the scissors sever the tissues the direction of the cut must be circular and just above the line of the attachment of the forceps. The very first cut will disclose the uninjured margin of the external sphincter, which serves as a guide in the subsequent progress of the operation.

The scissors are again employed to continue the cut in the same direction, under the guidance of the eye and the index finger, about the entire circumference of the anus. As blood vessels are severed they are to be seized by heavy artery forceps, which are to be supported by the assistants, as many being employed as are necessary to completely control the hemorrhage. This may require three or four or a dozen, according to the vascularity of the tissues. When the circle of the anus has been made in this manner artery forceps will be dangling from the severed extremity of the mucous membrane and "T" forceps will be straightening down the lower inch of the rectum, which has been literally skinned away from the external sphincter, the latter being exposed throughout its entire extent by carefully completing the dissection begun by the first work of the scissors. The operator seizes the entire mass of "T" forceps in a bundle, and by exercising gentle and uniform traction upon them he will bring well into view the tissue to be amputated. Care must be taken not to remove too much of the skin surface, as that misfortune would result in a permanent condition of ectropium of the rectum. The first amputation of the tissue should be made at sufficient proximity to the attachment of the "T" forceps to leave a generous band of skin and mucous membrane still dangling from the anus.

This irregular and protruding rim of tissue, dissected up from the surface of the external sphincter muscle, is now to be seized at some part of its margin by a pair of dressing forceps and the part again amputated, but this time with great care. There is more danger of amputat-

ing too much than too little. If the part is held loosely by the tissue-forceps it will be observed that there is a well-defined depression which marks the point at which the skin covering the ischio-rectal fossa and perineum terminates in the more delicate integument, gradually passing into the mucous membrane and covering the hemorrhoidal tissue. The amputation should not be made at the bottom of this groove, but a margin of a quarter of an inch should be left around the entire circumference of the anus on the hemorrhoidal side. If the bleeding points have been well seized with effective artery forceps by this time they will not bleed if the forceps are removed. The margins of the severed mucous membrane which has retracted above the sphincters is to be seized by "T" forceps, symmetrically and closely applied completely around the intestine. When all these forceps have been applied, if traction is made upon them while they are held in a bundle by the operator and the outer surface of the protruding intestine be examined it will be found to be surrounded by the circular fibres of the gut, which at this point are numerous and constitute the internal sphincter muscle. With a pair of scissors the perpendicular fibres of the gut should now be severed and the internal sphincter pushed upward for at least half an inch. In accomplishing this a few hemorrhagic points will again be encountered, requiring the application of the artery forceps. The sigmoid packing must be removed, after which a careful examination of the external sphincter should be made to see that its fibres are not ruptured during the process of dilatation. The point where they are most liable to give way is located posteriorly, and if it has been torn the ruptured extremities should be reunited by a sheep-gut suture. The "T" forceps are then seized by the assistants, who once more hold them in symmetrically divergent directions, and the operation is completed by carefully stitching together the severed margins of the mucous membrane and skin with a continuous suture of sheep-gut. The lock-stitch is perhaps the most desirable form of suture to employ.

HEMORRHAGE. During the operation all hemorrhage is easily controlled by the artery forceps, and except in subjects of hemorrhagic diathesis it will be unnecessary to secure the severed arteries either by torsion or ligation. Occasionally, however, torsion may be necessary. Ligation is very seldom required. It is a good plan before closing the wound to thoroughly irrigate the wounded area so as to remove all blood-clots, as their presence is inimical to healing by first intention.

DRESSING. Dry dressing should be employed for the wound, as moist dressings soften the tissues and have a tendency to cause the sutures to cut through the mucous membrane and permit its retraction before healing has been accomplished. In a large majority of cases healing will take place by first intention and no further attention will be required to the wound than is sufficient to secure cleanliness. Occasionally either the skin or mucous membrane will show a disposition to tumefaction between the stitches, and if the ridges thus formed do not subsequently disappear, leaving a perfectly smooth and unbroken surface, these elevations will need clipping away with scissors.

AFTER-APPEARANCE. As the mucous membrane which has been brought down is of a deeper red color than that which was previously continuous with the integument there will always remain an abrupt

change of color at the anus between the pale skin surrounding it and the mucous membrane adherent to it. This natural appearance has deceived many surgeons who were not familiar with the final appearance of the American operation, and they have mistaken the meaning of the color and come to the hasty conclusion that the part had never satisfactorily healed. This same fact concerning the appearance of the parts is also true of the clamp operation just described. Frequently, and until the circulation has become thoroughly established in the cicatricial band where the mucous membrane and skin are united, the margins of the anus will be slightly sensitive. But in the course of time and under the ordinary treatment which any sensitive wound should receive this will all pass away, leaving the parts perfectly pliable, controllable, and in every way in a healthy condition. As a rule union takes place in both the clamp and American operations by first intention. But there are occasional exceptions. Surgical wounds do not always heal satisfactorily in any part of the body. Disappointments of this kind are more frequently met with in rectal surgery than perhaps in any other part, simply because it is so difficult to secure immobility of the tissues.

COMPLICATIONS. The irritation resulting from the operation frequently produces spasmodic action of the sphincters, which sometimes is so annoying for the first two or three days as to require the exhibition of hypodermics of morphine. The activity of the sphincter muscles is also brought on by coughing, laughing, sneezing, and to a very slight extent by breathing, especially in the abdominal respiration. This liability to disturbance of the wound by the action of the sphincter muscles, together with the fact that the nutrition is partly interfered with by sphincter tension resulting from the wound itself, and in some cases by the degenerated state of the tissues at the time of the operation, renders healing by first intention at times difficult of accomplishment. When from any of these causes the wound separates and retraction of the mucous membrane to a more or less extent results healing can still be accomplished by granulation. In a large percentage of this class of cases the final results are perfectly satisfactory, but occasionally, owing to the abnormal tension of the sphincters occasioned by the soreness of the part, a stricture of the anus results which may require subsequent attention for its relief. In exceptional cases the retraction of the mucous membrane will be a source of irritation and a secondary operation will be required to secure the desired result, though this should not be undertaken for some months, ample time being allowed for the tissues to regain their tonicity. Where stricture has resulted it may be corrected by the patients themselves by the aid of the dilators, employed once or twice a week, using the smaller sizes at first. The process of dilatation by the plugs is tedious, and is only necessary where the patient is inaccessible to a surgeon. The stricture is best broken up by the surgeon under an anesthetic, and in accomplishing this the narrow band of tightened tissue should be nicked with a pair of scissors in three or four places, always laterally, the parts being then carefully dilated to their capacity. Occasionally two or three sittings of this kind will be necessary to secure ideal results, although one interference is usually sufficient.

INCONTINENCE OF FECES. Incontinence of feces rarely results from the American and clamp operations, and when it does is always

curable. It is due either to the presence of a stricture such as has just been described, to adhesions between the wound and the sphincter muscles, making the muscles clumsy and imperfect in their action, or else it is a case where a rupture of the external sphincter has been permitted to go uncorrected. In women retroflexion of the uterus frequently prevents a satisfactory reaction, and a partial paralytic condition of the sphincter muscle continues for a longer or shorter time, according to the reactive power of the patient. Where the imperfect action of the sphincters is due to stricture or to adhesions between the mucous membrane and the muscular tissue the suggestions already given will be ample to correct the difficulty, except in cases where an uncorrected sexual difficulty retards reaction. Where a condition of retroflexion, especially if the uterus be enlarged, interferes with the tonicity of the rectum the recovery of a case under such circumstances hangs upon the correction of the malposition of the uterus. If the muscle has been torn it may require uniting. All cases of the American operation should result satisfactorily if the work is properly executed and finished.

MEDICATION. As a rule medicines will not be needed in connection with aseptically performed operations for piles. If inflammatory symptoms of unusual acuteness arise it may be well to administer aconite for a day or two, preferably in the lower attenuations. It also assists in allaying the nervous perturbability of some patients after hemorrhoidal or other surgical operations. The usual symptoms of the drug will indicate its use.

If there be severe throbbing pain, with considerable congestion and engorgement, belladonna may be required. It is more likely to be needed in women than in men, and in patients suffering severe headache along with the rectal congestion.

Nux vomica and sulphur, as indicated, should not be overlooked. The former is especially applicable in old hemorrhoidal subjects of sedentary habits in whom constipation has been pronounced. Irritability of temper and excessive complaint after hemorrhoidal operations in such subjects call for nux.

Carbo vegetabilis, esculus, bryonia, and plumbum will be useful in selected cases. Ferrum phosphoricum is much like aconite and may supplant the latter remedy after the more intense symptoms have subsided. Chamomilla frequently allays excessive nervousness—the hyperesthetic condition of this remedy. Coffea may be needed to induce sleep, and if strangury or other vesical symptoms arise hyoscyamus should not be forgotten.

CHAPTER IV. PROLAPSUS RECTI.

Definitive Considerations.—Prolapsus of the rectum may occur at any age and to any extent, from the invagination of the lower part of the rectum to that of its entire length. It is not at all uncommon in children, being frequently an accompaniment of constipation. Whenever it exists, and from whatever cause, it is made possible by a weakened condition of the longitudinal fibres of the intestine. This would suggest weakened nervous force as a predisposing cause, and this theory is borne out in practice. Cases of prolapsus of the rectum usually present one of four accompanying conditions, all productive of nerve waste: First, a badly disorganized last inch of the rectum; second, the whole surface of the rectum is sometimes swollen and excoriated, in other words, presents a condition of chronic proctitis; third, a growth of some kind may be located along the surface of the rectum above the sphincters, and last, but not least, various forms of sexual abnormalities express themselves by exhibiting rectal irritability, prolapsus of the rectum being one of the common forms which irritability of this part assumes. The malady is not a difficult one to master. Nor in order to do so is it by any means necessary to employ the heroic processes formerly considered indispensable, namely, the removal of longitudinal strips of mucous membrane along the lower rectum or the portion of it involved, or cauterization of the rectum in streaks with crude nitric acid, or amputation of a large portion of the protruding mass.

Paralysis of the longitudinal fibres of the intestine can be cured as readily as paralysis of other parts of the body, and there is no more excuse for amputating a rectum that is paralyzed in a condition of prolapsus than there is in amputating an arm because it drops helplessly to the side. If there are tumors in the rectum, producing an undue amount of irritation and tenesmus, of course they should be removed if possible, great care being taken to control the hemorrhage at all points not guarded by the sphincters, as the relaxed state of the intestine favors its recurrence. Where the tumor is sessile and its removal from the intestine leaves a more or less broadened surface the bleeding points are to be seized by artery forceps as the tumor is removed. A continuous suture of sheep-gut is then to bring the margins of the wound together, and as the hemorrhagic points which are now grasped by artery forceps are approached a loop of the continuous suture is thrown around each point separately, so that as the margins of the wound are drawn together and the stitches tightened the arteries are gripped so tightly that hemorrhage is impossible, and the ligature will not slip because it penetrates the tissues. This same stitch is valuable in many other places in surgery, especially in laparotomies, as its employment obviates the necessity of ligating stumps in the removal of tumors and the pelvic organs. Where the surface of the tumor has occupied so much of the calibre of the intestine that the bringing together

of the surfaces which bounded its base laterally would narrow the intestine to such an extent as to produce a strictured condition of the bowel, this can be obviated by bringing the margins of the wound together longitudinally, as the mucous membrane of the rectum is always ample for plastic work, if it be drawn from its length rather than its breadth.

Pathology and Treatment.—In prolapsus of the rectum the anal sphincters will almost invariably be found in a dilated and weakened condition. A moderate degree of dilatation upon such atonic sphincters is very wholesome and stimulates them into a more vigorous condition. The last inch of the rectum in such cases is invariably faulty. Its hemorrhoids should be removed, and its pockets and papillæ trimmed away. These are the commoner forms of trouble encountered in this condition. Ulceration, fistulæ and fissures do not exist, as a rule, in such cases, from the simple fact that they are such severe forms of irritation that their tendency is to induce a clonic spasm both of the sphincters and all other muscular structures connected with the lower bowel. There is another reason, also, why these forms of irritation are not frequently associated with prolapsus of the rectum. They almost invariably involve terminal nerve fibres from the cerebro-spinal as well as the sympathetic nerve, so that the reserve power of both nervous systems is taxed to sustain the integrity of the tissues in spite of the undue strain put upon them.

While the internal and middle forms of chronic hemorrhoids and pockets and papillæ cause undue muscular tension it is the tension of the internal sphincter alone which is supplied solely by the sympathetic nerve; and as it is an exhaustion of this nervous force which permits the prolapsus of the bowel, the muscles which it supplies pass beyond the stage of contraction to that of paralysis much more readily where the entire distress is borne by the sympathetic nerve than when the sensations of pain and distress attract the attention of the cerebro-spinal system, and add the

stimulus of its reserve power to that of the overtaxed sympathetic. The muscles placed thus directly under the control of both nervous systems are more prone to spasmodic action and less to paralysis than where the sympathetic force alone is responsible for muscular activity. Pockets and papillæ and hemorrhoids should always be re-

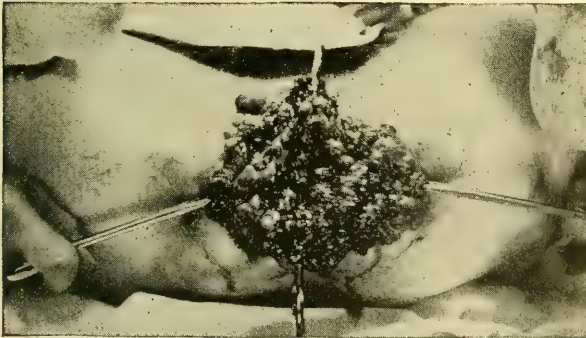


Fig. 738. Epithelioma of the Rectum. Same as Fig. 739.—Pratt

moved and the rectum carefully dilated. In bad cases it is well to perform the American or clamp operation upon the lower inch of the rectum, especially if the hemorrhoidal tissue be very abundant. The influence exercised over the rectum by sexual conditions is so pronounced that in the cure of prolapsus it is absolutely essential to see

that the sexual organs are in a good state of repair and that all sources of sympathetic nerve-waste be stopped. These latter will be discussed later.

ELECTRICAL TREATMENT. The employment of electricity is a valuable after-treatment in such cases, and should be used as follows: The secondary Faradic current is to be employed with the positive pole of the electrode in the rectum and the negative over the sigmoid or cecum. After the electrodes are adjusted in position the current is to be turned on until it is as strong as the patient can well bear. At this point the rod by which the strength of the current is increased is to be suddenly pulled out and replaced, thus increasing and diminishing the electrical current suddenly. This produces a spasmodic contraction of the muscular fibres of the intestine. By repeating this process a few times electrical massage will be secured, a few daily applications of which, in sessions of not more than five or ten minutes duration, will aid very materially in restoring tonicity to the weakened muscles.



Fig. 739. Epithelioma of the Rectum. External Appearance—Pratt.

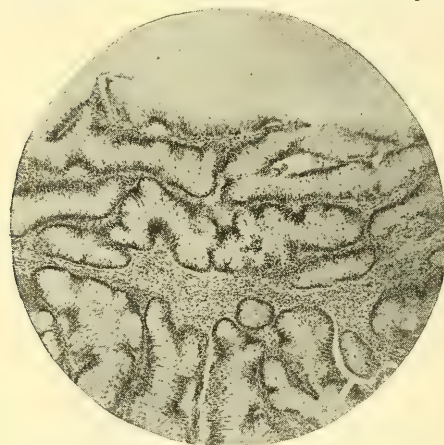


Fig. 740. Epithelioma of Rectum.—Pratt. X 60.



Fig. 741. Epithelioma of Rectum.—Pratt. X 200.

between times if it were not held in place by a rectal supporter. The entire surface of the rectum was covered with warty vegetations. Instead of producing a strictured condition of the bowel at any place it

seemed to produce paralysis. A small hand and arm were passed up this bowel beyond the elbow, and only at the tips of the fingers, when the arm was introduced as far as possible, could a smooth surface of the mucous membrane be felt. The sigmoid and rectum were completely covered with these vegetations. The operation performed in this case was dilatation, the clipping away with the scissors of as many of the growths as possible, and the curetting of the remaining surface, being careful not to use sufficient violence to penetrate the coats of the intestine. About six inches of the lower part of the prolapsed tissue was denuded of its mucous membrane, with its vegetative growth, and the severed margins were attached to the integument, constituting what might be termed a high American operation. It was necessary to remove a good deal of the mucous membrane in this case, not more because of the prolapsus than to exterminate as much as possible of the vegetation. As to the nature of the vegetation, Figs. 740 and 741 illustrate the microscopical appearance of the growths. Sounds were also passed upon the patient at the time of the operation, and he was circumcised. The subject made a very rapid recovery and soon left the hospital in greatly improved health. His present condition is not known, although he was still improving when last heard from.

The illustrations for this case are given in this connection because of the degree of prolapsus that existed with the carcinomatous condition of the mucous membrane. Microscopical section revealed that the growth was typically epitheliomatous in nature, but the pathological condition did not extend into the deeper tissues, and when heard from last, as stated, the patient was in fair way for general recovery.

MEDICATION. But little is to be hoped for from medication directed toward prolapsus recti. Plumbum, graphites, aluminum, podophyllum, nux vomica and other remedies have been given with more or less of benefit in individual cases, but, in the main, medication has proven of but little avail so long as irritable conditions continue, these sorely taxing the sympathetic nervous system. They should be removed and then medication may be of service in improving the general tone of the system.

CHAPTER V.

FISTULÆ.

Definitive Considerations.—Although fistulæ appear in a great variety of forms their story is a simple one and the principles of their successful eradication can be very briefly told and illustrated.

Rectal fistulæ are complete or incomplete. Complete fistulæ present two or more openings, one upon the mucous and the others upon the cutaneous surface, a double opening of a complete fistula upon the surface of the mucous membrane being an exceedingly rare affection. Incomplete fistulæ are blind pus tracks or "sinuses," and have but one opening. They are internal or external fistulæ, as this opening is located in the bowel or upon the skin surface. The latter form of fistulæ is nothing more nor less than the contracted remains of an ischio-rectal abscess. The rectum is not involved in this class of cases, and the track can be handled without disturbing rectal tissue. Dilating, curetting, cauterizing, tubing, excising, packing and dry cupping are a list of measures a part or all of which are ample for the cure of even the most aggravated cases. Incomplete fistulæ of the internal type have their openings between the sphincters and, usually about half an inch from the margin of the anus. These openings may be located anteriorly, posteriorly or laterally. From these internal openings they burrow in different directions, sometimes upward outside of the internal sphincter muscle, sometimes downward, embracing the external, and sometimes encircling the last inch of the rectum like a horseshoe, always externally to the muscular structure. Sometimes an incomplete internal fistula consists of one track, short or long, curved or straight, and sometimes the central track, which begins at this opening on the mucous membrane surface, branches in many directions like the arms of a cactus plant.

Treatment.—Whatever their variety, there is but one satisfactory method of treating fistulæ, and that is to accomplish their thorough eradication by dissection. The anus is to be dilated and the rectum and sigmoid thoroughly cleansed by the aid of the douche and sigmoid speculum. The surface is then to be carefully followed by "T" forceps and examined. If the circumference of the last inch of the rectum is not badly demoralized a case of incomplete fistula need not necessarily call for the American operation. In case, however, that the patient is one of lowered vitality and the last inch is considerably excoriated or completely bestudded with rectal pockets and papillæ, or presents a protruding mass of hemorrhoids, or for any other reason than the fistula calls for the American operation, this should be performed; and after all the earlier steps of the operation have been taken, and just as the parts are ready to be united, an assistant is to seize the "T" forceps which dangle from the mucous membrane in one hand and draw the rectum downward unto the side opposite the fistula, the internal opening of which has already been removed while performing the American operation.

If the pus track be a long and tortuous one and difficult of access the external sphincter can now be cut and its extremities held apart in order to afford more space for the dissection of the track. The entire track is to be dissected out by the aid of the tenaculum and scissors; after this is accomplished the sphincters are to be reunited by sheep-gut ligatures, and the American operation is complete.

Union should take place as in other American operations by first intention. As the fistula was obliterated at the time of the operation nothing further will be heard from it.

Complete anal fistulæ have their internal openings almost invariably between the sphincters, although occasionally they are just above the internal sphincter. The external opening or openings may be anywhere about the base of the body. Where there is but one opening it is usually located within an inch of the anus. Sometimes, however, it is several inches from it. In the male a complete fistula may have one or more openings upon the perineum or scrotum, and sometimes, in rare cases, in the urethra. In the female the external opening may be on the perineum, in the labia majora or minora, or in the vagina. In either sex the base of the body may be completely honeycombed by fistulous tracks, and the skin surface-covering irregularly bespattered with their external openings. Whether the external openings of a complete anal fistula be two or a dozen the canals which lead from them invariably center in one central fistulous track which presents but one internal opening,* and that is almost invariably between the sphincters.

The radical work of dissection in all cases should be confined to the central stem and its internal opening. If it be a single fistula and its external opening be several inches from the anus, the course of the track would be determined by the probe or director, and an opening be made into it near the margin of the anus. The portions of the track opening into the intestine should be treated radically, while all that will be required in treating the portion of the track opening upon the skin surface will be dilatation by the aid of graded female uterine sounds, and its curetting and packing with iodoform-gauze or jute. If there are a large number of external openings the track leading to each one is to be dilated and treated in a similar manner. Although the surface of the buttocks may be completely honeycombed by fistulous tracks it is by no means necessary to mutilate the skin surface to eradicate them.

AFTER-TREATMENT. After the central track is once destroyed by the radical process the branches of this fistulous tree are very easily exterminated. When they are packed by gauze, jute, candle-wicking, or any other substance, the packing should protrude upon the surface of the skin at both of its extremities, either by the pathological or surgical openings, and should remain without molestation for at least forty-eight hours in order to institute a satisfactory condition of reaction. They should then be removed and the parts thoroughly douched with a solution of carbolic acid, bichloride of mercury or calendula, as the surgeon may determine, after which they are to be repacked or not, according to circumstances. If the parts are very irritable and the first packing has instituted a high degree of inflammatory action, a few silk threads drawn through the canal or canals to ensure drainage will be all that the case will require. But if the parts are pale, anemic and inactive, requiring

still further stimulation to inaugurate activity in the wound, they are to be again packed one or more times at the discretion of the surgeon. The question of repacking should be determined before the first packing is removed, for if they are to be repacked a piece of silk thread should be attached to one of the protruding ends of the original packing while it is yet in place, and should also be tied to one extremity of the new packing to be introduced; so that when the old packing is pulled away the sinus will be occupied by the silk thread, and after the sinus has been thoroughly cleansed by means of this, new packing can be readily introduced without discomfort to the patient. After the packing process has been abandoned the sinus should be douched several times a day. The method suggested by Terry is advisable, namely, to be careful never to employ as an injection-fluid the same drug twice in succession. Iodine, carbolic acid, bichloride of mercury, calendula, peroxide of hydrogen, boracic acid, nitrate of silver, Bovinine and turpentine form a list of drugs from which selection can be made and prepared in strengths commonly used for douching purposes to be employed in succession, using three or four of them each day according to the severity of the case. Daily massage and dry cupping are also invaluable in extreme cases of disintegration and starvation of the tissues. Electricity should not be omitted from the list of the remedial agents in this class of cases, and perhaps the best form of it is the static, the daily application of which is a valuable stimulant to the healing process. The treatment of the central stem of the fistula and its internal opening is the most important consideration connected with complete anal fistula.

The margins of recto-vaginal fistula should be denuded from both the rectal and vaginal surfaces and the parts carefully stitched together with continuous or interrupted suture of sheep-gut. They are usually situated above the internal sphincter, and result from injuries in labor. Where the internal orifice of a rectal fistula opens into the urethra the rectal opening is to be dealt with in the radical manner to be described. Closure of this opening should suffice for the eradication of the fistula. Irritation of the urethra and the discharge of pus from the urethral extremity of the fistula in case it does not subside spontaneously can be reached through the urethra by means of sounds and douches, or, if necessary, perineal section can be made, the track dissected out and the difficulty thoroughly eradicated, as in cases of urethral stricture.



Figure 1.
Entering Director into Fistula.

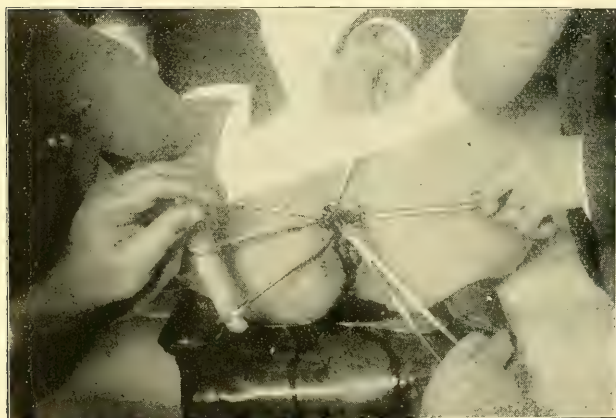


Figure 2.
Fistulous Track Transfixed.

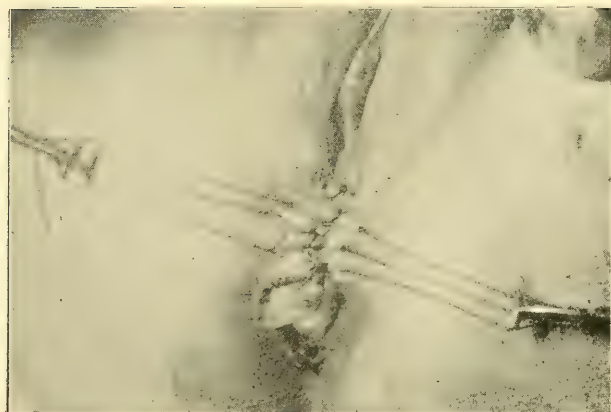


Figure 3.
Sutures Introduced.

PLATE XXII.

CHAPTER VI.

RADICAL TREATMENT OF THE CENTRAL FISTULOUS TRACK.

Differentiations.—Whether the track under consideration be long or short, single or multiple, by means of the procedures described in Chapter V the portion of the fistula to be treated radically can be reduced to a short tube, which may pursue a straight course into the rectum or may consist of an expanded pus chamber burrowing in different directions immediately around the last inch of the rectum. In the latter condition, regardless of the condition of the mucous membrane of the last inch of rectum, it is better to perform the American operation and completely eradicate the pus track after the manner described in treating incomplete internal fistula. If the fistulous track is a straight, uncomplicated one, however, and the last inch of the rectum is not sufficiently diseased to call for the American operation it is to be operated in the manner to be described.

Straight Fistula.—While the index finger of the operator is introduced into the anus and held at the internal opening of the fistula, a grooved director, entering the track at its natural or a surgical opening within an inch of the anus, is passed through the fistula until the point of the director strikes the index finger of the operator on guard (Plate XXII, Fig. 1). The point of the director is carried outward and the director pushed further until it crosses the anus, being covered in its central portion by the bridge of tissue which covers the fistula. This is severed with the bistoury, and while the lips of the wound are held apart by "T" forceps the bottom of the track is transfixed along its course by two or three tenacula (Plate XXII, Fig. 2) and the track dissected away with scissors. Every fragment of congested and cicatricial tissue should be carefully dissected away and the margins of the internal opening smoothed with the scissors. Sutures, more or less buried, according to circumstances, are now to be introduced from side to side (Plate XXII, Fig. 3), after which all small clots and debris are to be washed away by a thorough douching, and the wound carefully coapted by tying the threads together, thus completing the ligatures. These threads had better be of silk, kangaroo tendon, silk-worm suture or silver wire. In a week or ten days they may be removed, and if the parts have done well the central track of the fistula will be completely and permanently obliterated.

Before closing the wound whatever other forms of rectal trouble have been encountered should be corrected. The condition of the sexual organs should also be carefully examined, and all necessary operative work performed in order to avoid reflex irritation from sexual disturbance. The wound should receive a dry dressing and be cared for in accordance with accepted surgical principles. It will frequently be found necessary to employ a catheter for the evacuation of the bladder in either sex for a

few days after the operation. While this is not always necessary it is well to bear the fact in mind so as to ascertain by timely inquiry the presence or absence of strangury.

Anal fistulæ are sometimes temporarily treated by processes of dilatation, scarification, cauterization and injections. But they are so prone to recur after being healed by such processes that the radical method described is advisable for at least the inner extremity of the sinus.

In severing a fistulous track the external sphincter muscle will almost invariably be divided, as it is usually embraced by the sinus. In uniting the wound it is well to stitch the muscle separately with sheep-gut. Where portions of the muscle have been destroyed and the bringing together of its extremities shortens it abnormally, causing a strictured condition of the anus, sub-mucous section of it should be made at the time of the operation at a point as nearly opposite the wound made in dissecting away the fistula as is practicable. Sub-mucous sections should never be made immediately in front of or behind the anus, as at these points a portion of the sphincter decussates and does not readily reunite.

Sub-Mucous Severance of the Sphincters.—This is rendered occasionally necessary in operations for fistula, as just described, in operations for a complete rupture of the perineum, and in cases of such long-continued spasmodic action of the sphincter muscles from spinal irritation or from morbid conditions of the last inch of the rectum that the fibres of the muscle have become permanently thickened and shortened. The surgeon will be careful not to perform this operation except in properly selected cases, otherwise fecal incontinence may result, demanding a secondary operation. It is to be performed as follows:

The bivalve speculum is to be inserted and opened (Plate XXII, Fig. 4) sufficiently to render the external sphincter tense. The operation is best performed through the outer divergence of the rectal bivalve blades, and the speculum should be so placed as to bring into this field the point selected for operation. The thickness of the muscle should be now ascertained by palpation. The index finger of the left hand is now pressed into the ischio-rectal fossa so close to the sphincter muscle that it comes in contact (Plate XXII, Fig. 4) with the finger nail, separated from it only by the integument. With the speculum holding the muscle tense and the index finger still in position a sharp-pointed bistoury is passed through the integument at the extremity of the finger nail. The blade is withdrawn and replaced by a dull-pointed curved bistoury. After the knife has passed through the integument the surgeon's index finger should be withdrawn from the ischio-rectal fossa and inserted into the rectum just far enough to enable the finger to flex above the upper border of the internal sphincter.

While in this position the knife blade is to be passed upward outside of the sphincter muscles with the flat surface of the blade toward the intestine. As soon as the dull point of the bistoury can be felt in close proximity to the finger it should be made to penetrate the muscular coat of the intestine until it is separated from the index finger only by the mucous membrane. Its cutting edge is then to be turned toward the rectum, and by a sawing motion of the knife, the speculum still holding the muscular fibre tense, great care being taken not to do violence to the mucous membrane, the fibres of the sphincters are severed. The giving

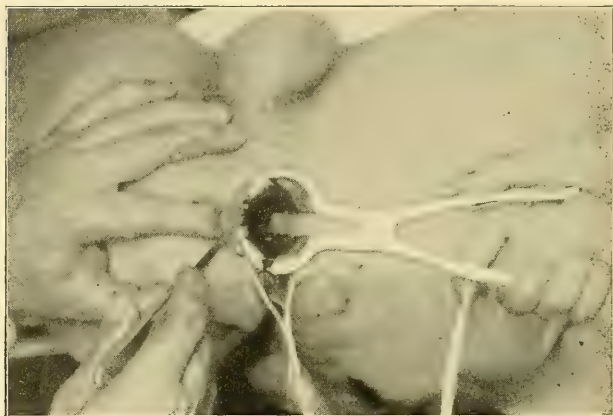


Figure 4. Sub-Mucous Severance of Sphincter Muscle.



Figure 5. Incising Fistula on Grooved Director.



Figure 6. Fistula Dissected out. Wound Exposed.

way of the sphincters will be perceptibly felt both by the operator and the assistant who is still holding the speculum. After all the fibres have been severed a finger can usually detect a groove where the fibres of the muscle have been parted before and after the speculum has been withdrawn. In case the mucous membrane should be wounded in this operation it should be immediately stitched with sheep-gut so as to completely cover the wound. No incontinence seems to be induced by the practice of muscle dividing in cases where it is indicated, as the intervening space caused by the retraction of the muscular tissue is speedily filled in by cicatricial tissue, which serves as a bond of union sufficiently firm to render the sphincter muscles as serviceable as ever. Only in cases where the muscle is already too long does the sub-mucous section of the sphincters induce incontinence. Where the operation is done in connection with the operation for fistula, or for the purpose of lengthening a shortened and hypertrophied muscle, the section of the muscle at one point is sufficient. In cases of complete laceration of the perineum, however, where it is of long standing and the sphincter muscles have been contracted so long that they are organically shortened, the first step in the operation, before any denudation of tissue, should be the sub-mucous section of the sphincters in two places. These points should be located laterally and just in front of the coccyx. Where, in such cases, the operation decided upon is the American operation, combined with the perineal, instead of severing the sphincter muscle in the sub-mucous manner described it is just as well to take advantage of their exposure during the American operation to sever them with a pair of scissors. In case the laceration of the perineum involves the external sphincter muscle only that should be severed. But where it involves both sphincters both require severing. The completion of the American operation acts as a perfect covering for the severed extremities of the muscles, and they unite satisfactorily as in sub-mucous section. Occasionally, if sub-mucous section be practiced well toward the perineum, or laterally, one of the branches of the middle hemorrhoidal arteries will be severed and the hemorrhage will be quite profuse. It is easily controlled, however, by pressure practiced firmly for two or three minutes. The rectum should not be dilated after sub-mucous section, as dilatation is liable to rupture the mucous membrane covering the wound.

CHAPTER VII.

RECTAL FISSURES AND ULCERS.

Fissures.—Much space has been occupied in surgical works in treating of fissures of the rectum, but their eradication is easily effected and they are not of such common occurrence as prolonged consideration of them would imply. They are elongated forms of ulceration, directed longitudinally, and located at the anus so that they are partly without and partly within the rectum. Where they exist singly they are almost invariably located posteriorly. Occasionally the entire circumference of the anus will be fissured at short distances. Such conditions are usually accompanied by pruritis ani. They are invariably accompanied by some other form of rectal trouble, which should be corrected at the same sitting. Where there is but one fissure the simplest and most satisfactory way of accomplishing its eradication is by dissection. The bottom of the fissure should be seized by tenacula through the expanded blades of a bivalve and carefully dissected away by either scalpel or scissors. The wound may be stitched or not, at the discretion of the operator. As a rule it is better to avoid stitches within the grip of the sphincters as there is no tendency of the part to displacement and it is better that wounds of this part should heal by granulation than to induce the strictured condition attendant upon approximating the wounded surface with sutures. Especially is this the case where much of the last inch of the rectum has been denuded. Fissures may be curetted, scarified and cauterized, after which dilatation of the anus is to be practiced, the results being, as a rule, satisfactory. Where the margins of the anus present a series of fissures and their dissection would involve the loss of a large portion of the mucous membrane in segments about the anus, after all pockets, papillæ, hemorrhoids, and ulceration have been properly treated, their scarification and cauterization is advisable.

Ulcers.—Ulcers of the rectum are of exceedingly rare occurrence, and if they are extensive are usually syphilitic, tubercular, or cancerous. The commoner form of ulceration of the rectum is the single ulcer appearing in the last inch, but it may be located anywhere about its margin. It is to be treated either by dissection or by scarification and cauterization, according to its size. Small ulcers should be dissected away, larger ones can be scarified, curetted and cauterized. Ulcerations of the middle and upper part of the rectum are to be treated by curetting and cauterizing. When syphilitic in their origin, regardless of the extent of the disease, a cure is, as a rule, easily effected.

DIAGNOSIS. Cancer of the rectum is to be diagnosed from syphilitic ulceration of the rectum by the history of the case, by its location, (its favorite seat being in the upper rectum) by its tendency to infiltrate, by the early formation of stricture, and its tendency to involve the deeper structures and to completely encircle the intestines. Cancerous subjects, as a rule, possess vigorous natures and unyielding dispositions,

and the rectums of such patients, like the rest of the body, are unyielding and are inclined to spasmodic action of the muscles involved. Syphilitic subjects possess the contrary characteristics. The tissues are soft and flabby, have a tendency to relaxation of the muscular coats of the intestine, rather than contraction, and the strictures that are formed are occasioned by cicatricial bands thrown out in an effort at healing rather than by the spasm of the circular fibres of the intestines. Cancerous strictures are usually confined to a narrow limit, while in syphilitic strictures the entire rectum may be involved. The microscope serves also to differentiate the conditions.

TREATMENT. Cancers may be located at the anus, in which case they can be excised with more or less success. Of course they are prone to recur, and the question of the usefulness of the knife in such affections is debatable here as in other parts. Unless the growth is sufficiently incipient to permit its thorough extirpation it had better not be undertaken. When located at the anus its thorough eradication usually involves the destruction of the sphincters and the lower part of the rectum including the muscular as well as the mucous coat. Where amputation of the lower rectum is demanded the severed extremity of the intestine may be brought down and attached to the integument, as in the American operation. Carcinomata of the upper part of the rectum are best treated by dilatation, with bougies, curetting, and medication. Curetting should be very carefully performed, as in cases requiring it the coats of the intestine are badly degenerated and a puncture of the intestine implies an opening into the peritoneal cavity, and is usually fatal. Where the disease is too far advanced to expect relief from these measures nothing short of colotomy will afford the patient any satisfactory degree of relief. Sometimes when cancer is located in the centre of the lower part of the middle rectum and is movable the intestine may be resected and the severed portions united. To accomplish this it may be necessary to split the anus posteriorly and divide the deeper structures as far as the coccyx. The diseased segment may be then dissected out, the extremities of the gut united, and the external wound closed. In such cases it is always better to preserve the sphincters and mucous membrane covering them if possible. In occasional cases the growths can be extirpated only after the removal of the coccyx or a portion or all of the sacrum. (Kraske, Kocher).

CHAPTER VIII.

STRICTURE OF THE RECTUM.

Import.—Strictures resulting from the American operation are trifling conditions to be overcome, and have already been sufficiently considered. Those of the middle and upper rectum, however, which result from processes of ulceration, either syphilitic, tubercular, or carcinomatous, are formidable affections, and too great care cannot be exercised in their manipulation.



Fig. 742. Sigmoid Speculum.

Treatment.—Soft rubber, olive-tipped, French bougies (Fig. 743) are serviceable in this class of cases, as is also the smaller sigmoid speculum, although both these must be very carefully manipulated. In treating cases of this nature the integrity of the tissue can readily be estimated by observing the character of the tissues in the lower rectum. If the latter are in a fairly good state of preservation and present a considerable degree of integrity it indicates a vigor of the system that would throw out a sufficiently firm zone of inflammatory products about the stricture to sufficiently protect that portion to enable the operator to dilate with bougies and employ curetting to a considerable extent with perfect safety. But if the walls of the lower rectum are atrophied, anemic and flabby, rupture of the intestine and consequent puncture of the peritoneal cavity



Fig. 743. Olive Tipped Bougie.

are very liable to occur from the use of either the bougies or sigmoid speculum. The speculum, in such cases, should be invariably avoided, and only the smallest sized bougies should be employed. Curettage should not be undertaken. After the passing of the smaller bougies a wool plug, (Fig. 744) medicated at the discretion of the surgeon, may be carried within the stricture and permitted to remain for twenty-four or forty-eight hours, after which it is to be removed. Bougie treatments followed persistently, permitting an inserted bougie to remain for from fifteen minutes to an hour at a sitting, aided by rectal douchings and injections, will serve to prevent the bowel from closing, for a time, at least. The last resort in these cases is colotomy. As the severe forms of

ulceration of the rectum, resulting in stricture of its middle and upper portion, are invariably local expressions of a general dyscrasia which is either syphilitic, tubercular, or carcinomatous, constitutional treatment is a necessary supplement to local work. In syphilitic cases the exhibi-

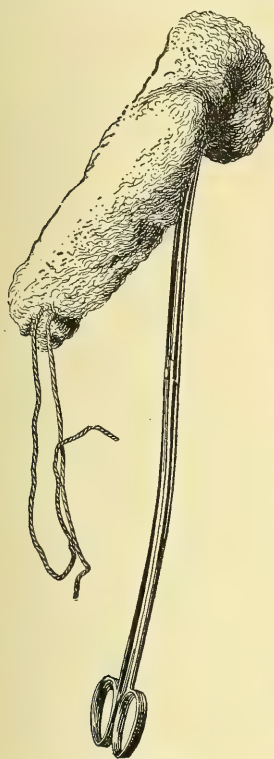


Fig. 744.
Wool Tampon.

tion of iodide of potassium, aurum metallicum, silicia, and other remedies demanded by the symptoms of the case are called for. In tuberculous, cod-liver oil, iodine suppositories, calcarea, mercurius solubilis, stannum, phenic acid, ferrum, and the iodide of arsenicum are selections from a long list of valuable drugs. For the carcinomatous dyscrasia arsenicum album, hoang nan, hydrastis canadensis, thuja occidentalis, carbolic acid, and red clover, are serviceable as internal medications, as the indications may demand, although the most that can be accomplished by any or all of them is a small degree of comfort and a brief truce with death. Erysipelas antitoxine is being tried also, but with doubtful success. It consists of the application by hypodermic injection of a culture of the bacillus erysipelatis directly into the pathological growth, usually being applicable to sarcoma, with the result that a destructive inflammation is set up, the sarcomatous mass presumably liquefying and being thrown off during the process and the system being brought under the toxic effect of the antitoxine to such extent that further development of sarcomatous growth is checked. Coley reports thirty-five cases of inoperable malignant tumors so treated, of which twenty-four were sarcomata, eight carcinomata and three of doubtful diagnosis; in five of the sarcomatous cases there were prospects, according to this author, of permanent cure. It is not believed, however, that this line of treatment is likely to supercede the use of arsenic, constitutionally and locally, and other systemic remedies, and surgical relief as indicated.

CHAPTER IX.

RECTAL POCKETS AND PAPILLÆ.

Anatomical Considerations.—The skin at the anus is reflected inward and is united to the mucous membrane in a well-defined white line, located at the upper border of the internal sphincter muscle. It is about an inch from the anus, sometimes more and sometimes less. Around the circumference of the intestine at this point are frequently found inverted sacs called pockets, and conical projections of mucous membrane varying in length from pin-point elevations, just long enough to be recognized, to projections a quarter or half an inch in thickness at their base and three-quarters of an inch or an inch in length. These papillary growths are called papillæ. The mouths of the pockets are directed upward, and they are projected into the mucous membrane toward the anus at a distance varying from a few lines to an inch. The mouths of the pockets and the bases of the papillæ are invariably located along the white line which marks the boundary line uniting the skin and mucous membrane lining the rectum. The papillæ may be diagnosed by the sense of touch or by the aid of a speculum. When the latter is opened if there are papillæ in the area between the blades their conical forms are plainly visible. By changing the position of the speculum their size and number can be readily noted. Rectal pockets are not so easily distinguished. When they are in an irritable condition a small semi-circular area of redness may be distinguished between the blades of an expanded speculum just above the dividing line between the skin and mucous membrane just mentioned. If these areas be carefully examined their deeper color will be seen to fade away upward into the uniform color of the intestine.

Below, the deep color will be bounded by a sharp horizontal line of mucous membrane, behind which is the mouth of the pocket. The depth and breadth of the pocket can be easily ascertained by means of a blunt-pointed hook. These irritable mouths of pockets are often mistaken for rectal ulcerations. But they are not ulcerations, as the mucous membrane at these points is simply in a condition of chronic inflammation and is not even eroded. The existence of pockets in a rectum is by no means constant, although they are found to exist in a majority of patients. As examinations are usually made only upon the sick the proportion of their presence among people generally will perhaps never be known. As mentioned above, however, it is by no means uncommon to encounter rectums, even of invalids, which are entirely devoid of them. When present they vary in number from one to sixteen or more. There are seldom more than six or eight in a single case. Where but one exists it may be located either anteriorly, posteriorly or laterally. Two or three may exist in close proximity side by side. As they are more common in children than they are in adults the question suggests itself whether or not they are relics of unperfected fetal development. They are so irregular in their number, and their removal is so universally beneficial, and never in the least injurious, that it is an error to regard them

as other than pathological formations. As local sources of irritation they are frequently the cause of stinging pains in the rectum, and are the most common cause of pruritis ani. Yet although this be true many times the patient is not made conscious of their presence.

Treatment.—Their eradication is a simple matter, although two or three sittings are frequently required to accomplish it, as they manifest a disposition to reproduce after removal. The best means of exterminating them is that of excision. The blunt-hook is to be engaged in each pocket separately and its roof clipped away with a pair of scissors, whose blades should be made to hug the peak of the blunt-hook so as to avoid wounding the deeper structures of the rectum. Where there is no redundancy of the anal mucous membrane a tenaculum may be employed to elevate the roof for removal in place of the blunt-hook, as the calibre of the tenaculum is smaller than that of the blunt-hook and less membrane will be sacrificed in the process. All rectal pockets should be exterminated, regardless of the amount of irritation which they present, as they frequently present an ulcerated condition at their bottom without any physical indications of their inflamed condition. They respect neither age, personalities nor conditions. And as the troubles which they occasion are usually reflex they are too frequently overlooked in searching for the cause of chronic diseases. When located posteriorly they are apt to induce coccydynia, irritation and congestion of the spine and occipital headache. When located laterally they are liable to cause pain in the hips, knees and feet. When located anteriorly they are prone to disturb the sexual functions. In all operations upon the rectum their presence should be recognized and their extermination thoroughly secured. The removal of the pockets as well as the correction of other forms of pathology encountered should be accomplished. Their presence induces clonic spasms of the internal sphincter muscle, and the anus should always be thoroughly dilated after the pockets have been removed.

Pockets.—These also vary in number. Frequently but one or two are encountered, and there are seldom more than five or six in a single case. Occasionally they occur in pairs a short distance apart, and in such cases a pocket always exists between them. They are to be snipped away to the level of the mucous membrane by a pair of scissors, a tenaculum or plug forcep serving to steady them for amputation. Each one contains an arteriole, but the hemorrhage following their removal is insignificant. This is also true of the removal of rectal pockets. A normal rectum is perfectly smooth and presents neither pockets nor papillæ, although some regard the latter as valves to prevent the escape of fluid, feces and gas.

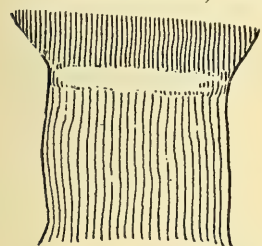


Fig. 745. Normal Rectum.—Smooth, Dilatable, Presenting neither Pockets nor Papillæ.

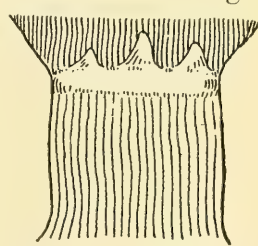


Fig. 746. Rectum Presenting Papillæ.—Sharp-Pointed Variety.

Surgical literature is almost entirely silent upon the subject of papillæ and is very meagre in its recognition of pockets. As their very existence has been almost forgotten or ignored for the last half century,

and as in the discussions which have taken place upon the subject in recent years many surgeons still regard the existence of rectal pockets as perfectly normal and their destruction as detrimental to health, notwithstanding the fact that they have never had any experience whatever in removing them and, consequently, have not had the opportunity of noting the effects of their extermination, and as the subject is considered of importance in the treatment of many forms of chronic disease it is necessary in order to present a fair consideration of it to refer briefly to a few of the places in medical literature where reference has been made to it.

Pockets and papillæ are variously described by the older anatomists. Bell, 1829, speaks of the rectum as a smooth membrane with

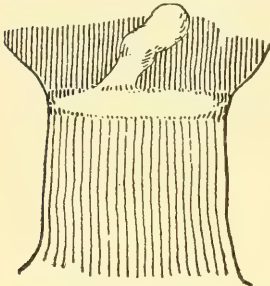


Fig. 747.
Single Club-Shaped Papilla.

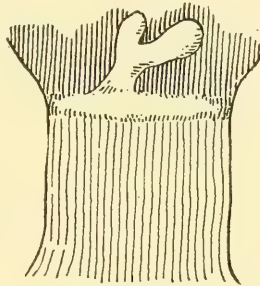


Fig. 748.
Single Club-Shaped and Bifurcated Papilla.

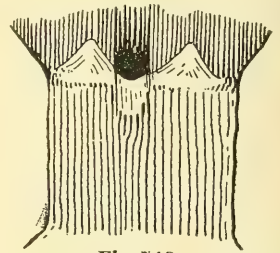


Fig. 749.
Double Papilla with Pocket Between. Common.

little foramina like the mouths of ducts, or follicles, which secrete a mucous discharge. Cruveillier, 1847, describes the rectum as being marked by a waved line forming a series of arches or festoons having their concavities directed upward from the angles at which the arches unite. More mucous folds proceed from these, allowing small foreign particles to be retained in the culs-de-sac to become the causes of fistulæ. Morton, 1849, quotes the last named anatomist but offers nothing new. Horner, 1846, speaks of the mucous coat of the rectum as abounding in lacunæ and glands. He also mentions longitudinal folds, called

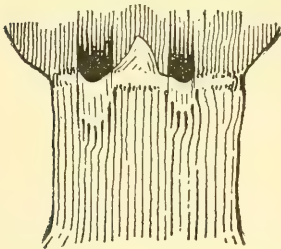


Fig. 750.
Papilla Between Pockets—Also common.

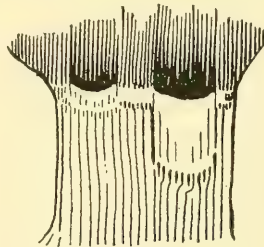


Fig. 751.
Two Broad-Mouthed Pockets, one shallow and one deep.

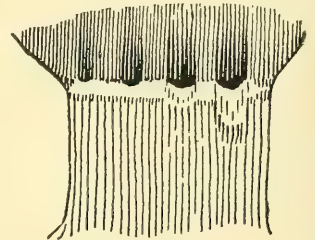


Fig. 752.
Three Stages in Pocket Development, frequently seen side by side, ranging from a mere depression to deep form.

columns, with pouches between them whose orifices point upward, these becoming occasionally the seat of disease, producing painful itching when enlarged. Coates, 1841, describes them as sacculi of the anus, and, with Horner, considers them wholly anatomical. Ribbes refers to Glisson, Ruysch, Morgagni, and other authors, in describing what are now recognized as pockets and papillæ. Physick described preternatural pouches

or cavities within the rectum, which were clipped off by the scissors after being drawn down by means of a bent probe. Gross, 1862, refers to Physick's investigations and pronounces the diseased conditions for which the latter author operated "sacciform disease of the anus," declaring that it consists simply of an altered condition of the sacs, pockets or pouches naturally existing in this situation.

In an elaborate article in the *Journal of Orificial Surgery*, for November, 1892, the author quotes extensively from the authorities

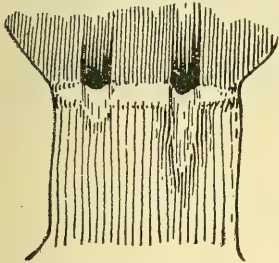


Fig. 753.
Narrow Pockets, one shallow
and one deep.

mentioned, and others, evolving from their views the various steps in the development of the knowledge of the present day upon the subject of rectal pockets and papillæ. It is believed that had the older anatomists and surgeons been possessed of modern instruments and methods it

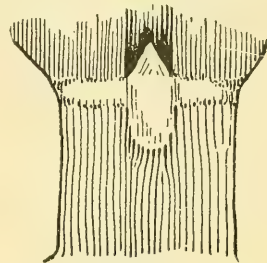


Fig. 754.
Papilla with pocket behind it.

would have been understood long ago that the conditions under description are pathological and not anatomical. A brief recapitulation of the subject justifies the following conclusions:

RECAPITULATION. (a). Rectal pockets are by no means a constant condition. It is very common to encounter rectums wholly devoid of the formations.

(b.) It is exceedingly common to find rectums possessed of merely one pocket, to find others possessed of two pockets, to find yet others possessed of three or four pockets.

(c.) It is quite uncommon to find rectums possessed of more than from five to eight pockets.

(d.) Occasionally an operator will encounter a rectum which possesses from ten to fifteen. The greatest number of pockets the author has seen in any rectum is seventeen.

(e.) It is not uncommon to find, in the same patient, pockets in different stages of development, situated side by side, one of which will present merely a red spot above this dividing line between the skin and the mucous membrane, located at the upper border of the internal sphincter as already described. Close to it will be another red spot which will engage the point of the blunt-hook perhaps a thirty-second or sixty-fourth of an inch. Adjoining this will be a third into which the blunt-hook will pass for perhaps an eighth of an inch.

(f.) When the patient possesses but a few rectal pockets the location of them is by no means constant. In one case it will be a single pocket under the prostate; in another it will be a single pocket on the side toward the coccyx; still another case will have but two, located laterally.

(g.) The pockets vary much in depth and also in width, sometimes being so shallow and narrow as to require the point of a dull tenaculum to engage them, and this for only a very short distance. At other times the inverted tube will be so long that the blunt-hook presented will not be of sufficient length to sound its depths. At other times the pocket will be wide-mouthed and shallow; at other times wide-mouthed and very deep.

(h). Sometimes pockets are very numerous but very small and shallow (this is especially true in cases of atrophy of the rectum), in other cases presenting a large number of pockets that will be both long and large, these latter being more characteristic in cases presenting hypertrophy of tissues.

(i). In children rectal pockets are more numerous, as a rule, than they are in grown people, suggesting the thought that they may be, possibly, the product of fetal development, which time is expected to eliminate after the manner of the hymen, the adhesion of the hood of the clitoris, and the contraction and adhesion of the foreskin; in which case they may serve to explain, as suggested by Holbrook, one of the causes of hemorrhoids, the irritation occasioned by the destruction of these delicate structures often serving to induce congestion of the blood vessels of the rectum.

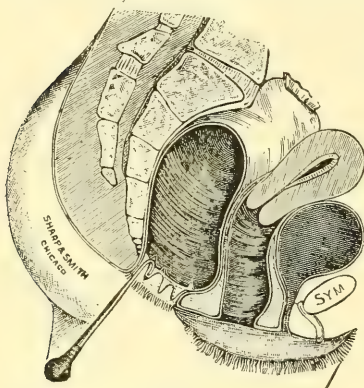


Fig. 756. Location of Pockets.

Fig. 756 illustrates not only the location of pockets but also the manner of detecting their presence by means of the blunt-hook.

Care must be taken to handle the instrument gently so as not to perforate the bottom of the pocket in making an examination. The presence of pockets occasions no discomfort to their possessor, who is, therefore, wholly unconscious of their existence. One or more must be badly ulcerated or inflamed, indeed, to be the seat of any sensations whatever, as they would have to penetrate far enough to involve the terminal nerve fibres of the cerebro-spinal system, which are limited in their distribution to the margin of the anus.

(j). The removal of rectal pockets, be they one or a dozen, is never detrimental in the slightest degree to the health or happiness of the individual; it disturbs no function and causes no inconvenience or disorder of either the rectum or any other part of the body.

(k). On the contrary, it is the unanimous opinion of those who are in the habit of removing rectal pockets that the practice is universally beneficial to the functional activities and health of the entire body of the patient operated upon.

The author has yet to learn of a single surgeon who has engaged in the practice of removing pockets and papillæ who repudiates the practice.

(l). There is no more satisfactory work in the scope of practice,

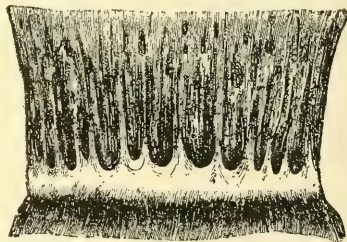


Fig. 755.—Rectum Occupied by Numerous Pockets.

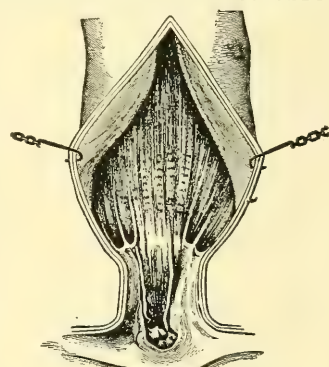


Fig. 757.
Rectal Pouch Torn Down and Ulcerated.—*British Medical Journal*.

judged by the standard of health and satisfaction enjoyed by the patients, than the removal of rectal pockets from those who are unfortunate enough to possess them.

Papillæ.—In the same location where pockets are found, namely, at the upper border of the internal sphincter, many times are seen small conical projections which, from their shape, are well named, papillæ. They are little teats which vary in size and length from the point of a pen to the last joint of the little finger. They are usually transparent at their tips but sometimes are club-shaped and even bifurcated and without transparency. They usually occur singly, although sometimes they appear in pairs, in such cases uniformly presenting the mouth of a pocket between them. The author has been able to find them mentioned in standard medical literature in but two or three places, and yet they are very common.

Their removal is invariably followed by very pronounced beneficial results to the patient, whatever may be the nature of the reflex trouble from which he is suffering. These two conditions, pockets and papillæ, are considered the most mischievous of rectal troubles, because their location is such that the irritation which they occasion induces a clonic spasm of the internal sphincter muscles, thus inaugurating a perpetual nerve waste of the sympathetic; and no work in surgery is more magical in its action than the smoothing of this upper border of the last inch of the rectum by removing from it all pockets and papillæ which it presents, and, by dilatation, removing the undue muscular tension which their constant presence has occasioned.

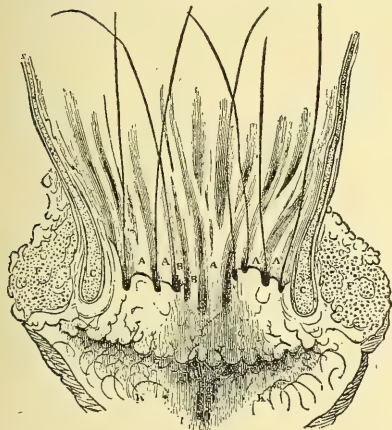


Fig. 758.

Vertical Section of the Anterior Parietes of the anus showing relations of sacculi of middle region and relations to surrounding parts, their orifices being marked by bristles. A. A. Columns of the Rectum. B. B. Rudiments of Columns. C. Internal Sphincter. F. External Sphincter. I. Rudimentary or Imperfect Sacculi. K. K. Radiated folds of the skin, terminating on the surface of the nates.

A bristle is in each one of the sacs.

hypertrophied conditions of the papillary layer of the margin of the skin at this point. Their removal is easily effected by means of either tenaculum or forceps and a pair of curved scissors, through a speculum.

The normal lining of the last inch of the rectum is perfectly smooth when dilated by the bivalve speculum, presenting neither excavations nor prominences, and above passes as uninterruptedly into the mucous membrane of the middle rectum as the skin passes into the mucous membrane at the margin of the lips.

CHAPTER X.

PRURITIS ANI.

General Considerations.—This is a very annoying affection, and is considered obstinate and difficult to cure, simply because it has been regarded as a disease *per se* rather than the effect of morbid conditions elsewhere. Itching surfaces about the anus have been cauterized and curetted and douched and powdered and anointed, frequently to no purpose except the affording of temporary relief. All that is necessary to completely and permanently eradicate the annoying affection is to secure a normal condition of the last inch of the rectum and of the sexual organs. It is common in men, uncommon in women. It may accompany any form of rectal or prostatic pathology.

When pruritis exists in women it is usually located about the vulva, especially at its upper part, and involves the hood of the clitoris and the labia majora and minora. Its cause is usually some form of uterine irritation, and it can be successfully treated only by removing the cause. In men, when prostatic troubles express themselves in the form of eczema they locate it upon the foreskin or scrotum; but it is not at all infrequent for them to produce pruritis ani, which is persistent and difficult to cure simply because its cause is not recognized and properly treated.

Treatment.—Owing to the thickened condition of the integument at the anus, resulting from the friction which the patient is compelled to indulge in for the purpose of temporary relief, the tension of the sphincters, especially of the external, is extreme, and in the treatment of the case dilatation will be more frequently called for than in other affections of the rectum. Rectal plugs will be found very serviceable and can be employed once or twice a week, or daily, as the parts may tolerate.

The first thing to be done, of course, when a patient applies for relief from itching of the anus is to prepare him for operation, place him under an anesthetic, and eradicate as far as possible all forms of pelvic pathology encountered. The use of the plugs before this is done will be liable to aggravate rather than relieve.

MEDICATION. Various remedies have been prescribed with more or less of benefit for pruritis. Arsenicum, graphites, kali muriaticum, thuja, sulphur, zincum, phytolacca, causticum and rhus tox. have been given with benefit. But if the pathological conditions described be present remedies will be of but little avail. Whereas with those corrected medication will be found helpful in allaying many of the symptoms of irritation and discomfort.

CHAPTER XI.

SPECIFIC OPERATIVE CONSIDERATIONS.

Dilatation.—No operation upon the anus should be performed without being immediately followed or preceded by anal dilatation. The general action and uses of dilatation of the anus will be considered later on, in connection with the systemic effects of orificial surgery. In the present connection, however, it is proper to mention a few important points to be borne in mind in employing it in connection with operations instituted solely for relief from local suffering. One general rule should be observed in all cases. Wherever, as in the American operation or severe clamp operations, or fistula in ano, stitching of the rectum is required, dilatation should always precede the operation. But in the lighter forms of work, as in the slit operation, in the removal of pockets and papillæ, and in the excision of ulcers and fissures, dilatation of the anus should follow the operation. The reasons for this rule are obvious. Dilatation after stitches have been introduced would disturb the stitches, and if practiced before any local patchwork short of the removal of the pile-bearing inch it causes such tumefaction of the part, frequently inducing hematoceles, as to obscure the local conditions and render the operation less accurate and more difficult.

The usual instructions for dilating an anus are to employ sufficient force to rupture the muscular fibres and produce a temporary paralysis of the sphincters. This is an unnecessarily extreme degree of dilatation and is frequently harmful, as it has a tendency to permanently weaken the anus. It is necessary to exercise more care in dilating the anus in slit work than it is in the operations which renew the last inch of the rectum; for if the sphincters are ruptured in slit work they cannot be reunited without more dissection than the operation undertaken calls for, while in the American or clamp operations the lower part of the membrane can be raised if necessary and the muscles searched for points of rupture and reunited before the membrane is stitched to the integument. The rupture invariably takes place posteriorly.

The author views dilatation of the anus as an edged tool in the hands of an operator to be handled with extreme care. While it is a power which can arouse the sluggish its too severe application can also depress and shock, in a most profound manner, the sensitive. When dilating to simply loosen the grip of the sphincters for the performance of work which is instituted merely for the relief of local troubles dilatation should be practiced with as little violence as possible. It is best accomplished by the aid of the bivalve speculum. After operations upon the rectum the tension is liable to recur from two causes, namely, the local soreness and from spinal irritation. It is in the class of cases which possess spinal irritation that the sphincters usually contract so continuously after the American and clamp operations as to induce stricture in the healing process. The strictures following the American and clamp operations

are easily overcome. Sometimes they can be readily handled by the aid of the plugs, speculum and scissors without an anesthetic. In sensitive people, however, an anesthetic may be required, under which the cicatricial band can be nicked in three or four places, avoiding the anterior and posterior localities, and the part can be smoothed with scissors and dilated at the discretion of the operator.

Where dilatation is practiced for the relief of cicatricial formations, in addition to rupturing the cicatricial band it usually tears the skin and mucous membrane in one or more places to a slight degree. Although this creates local soreness it soon heals and is not harmful. It is better, by means of fomentations, ointments and internal medication, to subdue all acute conditions before secondary dilatation is practiced. In a large percentage of cases a second dilatation is by no means necessary, and like other unnecessary surgical work is to be avoided.

Examination of the Rectum.—An examination of the rectum is best made at the time of the operation while the patient is under the anesthetic. Or the patient may be placed in the genu-pectoral position, the speculum introduced and the air admitted, when the rectum will be well exposed to view. There are two things to be noted; the condition of the mucous membrane and that of the deeper parts. The condition of the mucous membrane is to be ascertained by palpation and inspection. Palpation is secured by the introduction of the index finger, by means of which the location of the internal openings of fistulæ, the presence of papillæ, or an ulcer, or tumors or strictures, can be easily made out. The inspection can be practiced in two ways. One through the blades of a speculum first introduced and then expanded. In this field the color of the membrane can be noted and the presence of pockets, hemorrhoids, ulcers, etc., can be readily distinguished. If necessary, however, the mucous membrane for a distance of three or four, and sometimes more, inches can be exposed by the aid of "T" forceps without the aid of the speculum. The skin about the anus can be seized by "T" forceps applied in a circle, which by traction can be made to evert the anal tissues. Another row of forceps can be applied at the highest point observable, and traction upon these will expose a still higher field, and so on. In exposing the upper part of the rectum in this manner the forceps should seize the muscular as well as the mucous coat so as to avoid tearing the membrane. If the tissues are friable an examination by this method should not be attempted, as serious injury could easily be effected. The deeper tissues are to be examined by palpation with the thumb and index finger. Tumors, pus cavities and fistulous tracks are in this manner easily located and outlined.

After-Treatment.—It is especially important in rectal operations that the wounds be kept clean. Douches and applications should be used after all forms of operation once, and usually twice, a day, and always be accomplished in the gentlest manner possible.

The influence which the rectum wields over the entire system should always be borne in mind, and when it is necessary to expose any part for the purpose of douching or the application of drugs, it should be accomplished as much as possible by drawing the tissues apart by the fingers while the patient is straining, as at stool, rather than to submit the patient to the distress of introducing instruments. There is one

instrument, however, whose introduction after all forms of excision and slit work are performed which is quite important and which can be employed without such a degree of pain as to render its employment objectionable—the rectal double douche-tube. By pulling back the integument of the part with the fingers and requesting the patient to strain down, this instrument, warmed and well anointed, can be readily inserted into a rectum with comparative ease, the operator being careful to hug the sheath of the instrument close against its plunger. After the tube has been carried as high as desirable the plunger can be pushed beyond its sheath, and the syringe which is attached to the outward extremity of the plunger can pour its contents through the tube in its centre into the rectum. The openings at the upper end of the plunger are directed backward so that the water is not thrown above the instrument but washes all the debris backward into the encasing tube, which passes the water and debris into the pus-pan held for its reception. By gradually pulling out the encasing tube and keeping the plunger at a little distance from it the mucous membrane of the lower part of the rectum can be thoroughly cleansed without discomfort to the patient. As soon as the tube is withdrawn the anus will shut down upon the plunger, when the patient must be instructed to strain as if at stool, and the plunger is then carefully withdrawn. In doing so it thoroughly douches the last inch of the rectum. After this the anus can be douched by a direct stream of water, and the selected applications can be made.

It is not desirable to employ the double douche-tube during the first week or ten days after the American or clamp operations, as retraction of the external parts and the introduction of the instrument are liable to tear the attachment of the skin and mucous membrane apart before the parts become firmly united. It is never necessary after any form of operation to confine the bowels by opiates. The rectum is just as sensitive to being hurt as the rest of the body, if not more so, and the sense which peristaltic actions manifest in this direction is remarkable. The fright of the intestine assumes either one of two forms. Owing to the local soreness the system seems to recognize the inadequacy of the part to perform its usual functions and so refuses to act, keeping the patient involuntarily in a constipated condition for a sufficient length of time. When the patient is a panicky one and pain throws him into a condition of genuine consternation the bowels sympathize with this state of general fright, react from the condition of constipation, and indulge in a condition of terror which expresses itself in the form of diarrhea. As this does not disturb the position of the muscles and mucous membrane, requiring no distension of the anus for the discharge of the liquid feces, it is by no means objectionable; but increased care should be taken to keep the part thoroughly cleansed after each evacuation.

Blood-poisoning is more liable to occur from rectal work, perhaps, than from surgical procedures upon other parts of the body, because the sphincters have a tendency to grip down upon the inflamed surface and force poisonous matter back into the absorbents. Cleanliness, therefore, is all-important after all forms of rectal work.

After the clamp or American operations the first evacuation of the bowels should be accomplished between the fourth and sixth days, according to the condition of the patient. After slit work this can be secured

between the third and fifth days. Enemata or purgatives, or both, may be employed to secure the first passage after the operation, according to the habits and condition of the patient and at the discretion of the surgeon. In inaugurating the first passage it is well to inject a few tablespoonfuls of olive oil once in two or three hours, these to be followed by a large enema of soapsuds or warm water, medicated with hamamelis or boracic acid or golden seal or carbolic acid or ox gall or other drug, as the surgeon may deem best. The horizontal position should be maintained at the time of the first passage after most surgical work, after which the patient can assume the perpendicular position. The general as well as the local condition of the patient is to be considered in settling this point. Irritable, sensitive and delicate cases must be handled with extreme care, and it is much better that the first passage of such cases be accomplished in the horizontal position. If the task prove a severe one and the patient bethrown into a chill, followed by high fever, where the internal exhibition of such remedies as aconite, belladonna, arsenicum and quinine may be deemed necessary, a hypodermic injection of morphine in cases that will tolerate its employment is invaluable.

After douching cases that have received the American, clamp or fistula operations dry dressing should be employed. Some form of powder or cerate should be applied after the parts have been douched and well dried.

After all forms of slit work fomentations should be applied to the anus for several hours. The water employed for this purpose may be medicated with hamamelis, carbolic acid, calendula or boracic acid, as the surgeon may dictate. Small bits of flannel cloth should be rung out of whatever solution is selected, prepared as hot as can be borne by the patient, and while the nates are held apart should be made to hug the anus closely. This will check all tendency to hemorrhage or edema and very speedily remove the soreness from the parts. In applying fomentations two bits of flannel cloth will be required, as one is to be applied as soon as the other has been removed so as not to expose the part to the influence of the air longer than is necessary. Outside the flannel compress a towel can be folded, against which a bag of hot water may rest so as to render it necessary to disturb the part less frequently than would be required without it.

There is little pain following slit work upon the rectum, even where it has been quite extensive, and fomentations can be relied upon to sufficiently control it.

After the American, clamp and fistula operations, however, there is usually a tendency to a spasmodic tension of the sphincters, even while the patient is asleep, and hypodermics of morphine will be required more or less frequently for the first two or three days.

After slit work the urine can usually be voided without the aid of a catheter, especially if fomentations of hot water be applied over the sexual organs when micturition is desired. Whenever stitches have been applied about the anus they usually induce strangury, more or less persistent, and the use of the catheter will be indispensable for from one to eight or ten days, according to the individuality of the case. Where it is necessary to practice catheterization for any considerable length of time

the bladder should be douched with a boracic acid solution daily to avoid poison from residue urine.

Imperforate Anus.—Impervious anus is occasionally encountered in newborn infants. In such cases the sphincters are to be located and can be recognized by palpation. A knife is to be inserted through the skin just above the depression which marks the centre of their grip. A grooved director is to be passed through this and into the intestine. Polypus forceps are to be pushed along the groove of the director, the director removed, the blades of the forceps expanded and withdrawn, and then graded uterine sounds can be employed to enlarge the opening still further, and, finally, the little finger of the operator can be inserted. Where the bowel presents an opening into the vagina instead of at its normal place the proceeding described is to be practiced, after which the vaginal opening of the intestine is to be located and the grooved director passed into it. The perineum between the new opening made and the grooved director is to be entirely severed, the anterior part of the track obliterated, and the intestine made to follow its normal direction. Such cases are rare.

Therapeutic Hints.—In operations upon the rectum, as upon other tissues of the human body, reactionary febrile disturbances often occur which will call for aconite, ferrum phosphoricum, gelsemium, veratrum viride or belladonna, while shock, nervousness, sleeplessness, strangury, etc., are also seen. In cases demanding medication the remedies demanded should be employed to the exclusion of other and possibly harmful methods. Chamomilla and coffea will frequently allay the nervousness following rectal work, while hyoseyamus should not be forgotten in the same connection. Aconite is especially useful in reactionary conditions, and belladonna and veratrum viride best meet congestive states. If collapse follows, veratrum album, camphora and carbo vegetabilis form a useful trio.

The value of hot fomentations should not be overlooked, and as required hops, hamamelis, calendula, or other soothing local applications may be resorted to.

CHAPTER XII.

SURGERY OF THE ORIFICES OF THE MALE SEXUAL ORGANS.

Divison.—The subjects to be noticed under this heading are the foreskin, the frenum, the meatus and the urethra.

Foreskin.—A foreskin that projects beyond the point of the penis is abnormally long and should be amputated. One that adheres to the glans penis, either entirely or in part, care being taken to examine especially the groove just above the corona glandis, is to be loosened. The presence or absence of smegma is of little consequence, as the object to be accomplished is to liberate the terminal nerve fibres from undue impingement occasioned by the adhesions. A foreskin that squeezes the glans penis upon retraction and chokes it so as to be replaced with difficulty, producing a condition of paraphimosis, is too tight and should be liberated by a slit along its dorsum.

CIRCUMCISION. While there are many methods of performing circumcision the following one is sufficiently satisfactory to obviate the necessity of referring to others.

After the parts have been properly prepared and the urethra and frenum have received proper consideration the foreskin is to be seized by the operator and its lower border searched for a point at which the mucous membrane becomes continuous with the integument which covers it. A tenaculum is made to transfix the margin of the foreskin on its under side. The instrument is passed to the hands of an assistant and while sufficient traction is being exercised to straighten the tissues another tenaculum is inserted directly opposite. While the assistant is



Fig. 759.
Prepuce Distended.

rendering the foreskin tense by means of these tenacula, in such manner as to give its opening the appearance of a long narrow slit, extending at right angles to the direction of the organ, the intervening margins are secured in the grip of a "T" forceps midway between the tenacula. (Fig. 759). The tissues are to be held tense by traction upon the tenacula and "T" forceps; the mucous membrane lining the foreskin, by its attachment to the corona, limits the possibilities of tension so that there is no

danger of stretching the tissues too far. The operator can easily locate with the thumb and finger of one hand the position of the point of the glans penis. A sharp, narrow-bladed scalpel is made to pierce the foreskin beneath the attachment of the "T" forceps on a level with the point of the glans penis. (Fig. 760). The cutting edge of the knife

is to be turned toward the under side of the organ and the lower half of the foreskin severed on a line parallel with its free margin. (Fig. 761). A pair of scissors is now employed to amputate the remaining half. (Fig. 762.)

In doing so the scissors are opened and, starting from the upper edge of the wound made by the introduction of the scalpel, the foreskin is to be severed from below upward in a line not parallel with the margin of the foreskin, as was practiced with the lower half, but curving upward and backward at an angle sufficient to make the upper angle of the amputation on a level with the edge of the corona. This is practically removing a V-shaped piece from the dorsum of the foreskin. The severed margins of the skin and mucous membrane are now to be sutured by a continuous sheep-gut suture, after which another sheep-gut suture is to be employed to close the amputated foreskin over the point of the glans. (Fig. 763.)

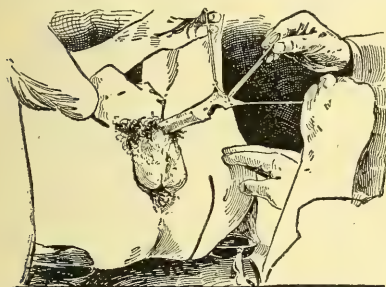


Fig. 761.
Lower Half of Prepuce Severed.

amputate the entire foreskin, thus leaving the glans and corona permanently exposed. This is believed to be unnecessary. The author much prefers securing the ideal result previously outlined, namely, a foreskin which is worn, when the organ is relaxed, in a manner which covers the corona and the upper half of the glans, leaving merely the apex and lower half exposed. As the sutures employed are sheep-gut they will not require removal.

In cases where adhesions between the foreskin and glans are encountered these should be broken up before circumcision is performed. Subsequent to the operation in such cases the adhesions between the glans and prepuce will reform; but after the severed margins of the mucous membrane and skin are well united these can easily be broken up and kept from reuniting by daily anointing with cold cream or carbolated vaseline.



Fig. 760.
Prepuce Pierced.

The object of this last procedure is to hold the foreskin moderately tense over the glans while the raw surfaces are agglutinating; otherwise erections, which are liable to supervene from the presence of the stitches, would cause the foreskin to retract back of the glans, and either interfere with the healing of the wound or insure its healing in a thickened ring of tissue which would remain permanently retracted about the margin of the corona. Many surgeons prefer to

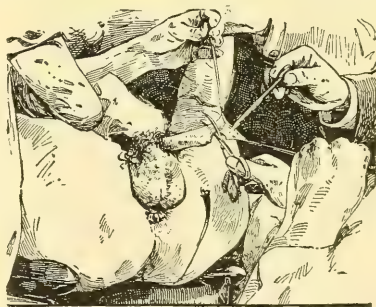


Fig. 762.
Amputation of Prepuce.

Circumcision is practiced by some surgeons under the action of cocaine hypodermically employed; but as cocaine predisposes to hemorrhage, interferes with the healing, and its employment hypodermically is accompanied with more or less danger, it seems to be preferable to perform the operation under the action of an anesthetic, a mixture of ether and chloroform being the choice for grown people and chloroform for children.

Frenum.—A frenum that depresses the point of the penis upon extreme retraction of the foreskin is too short and should be severed. It should be snipped close to the glans penis, care being taken to sever nothing but the mucous membrane. A shortened corpus spongiosum which depresses the point of the penis is not a serious deformity, as it exercises no traction upon the meatus.

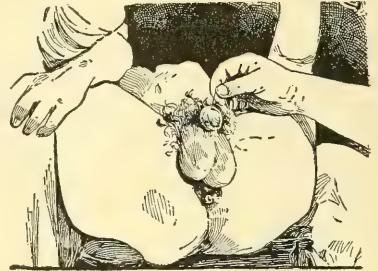


Fig. 763.
Suturing of Prepuce Completed.

Meatus.—**INCISION AND DILATATION.** When the meatus is too narrow it is to be enlarged by severing the thin membranous structure which completes it below. If the cut is carried beyond this point and the part of the corpus spongiosum which enters into the formation of the glans be wounded it is liable to destroy the power of erection, and is, consequently, to be avoided. In deciding the question as to the proper size of the meatus an Otis bulb sound may be employed. A size should be selected as large as can be passed through the meatus, and if in passing the instrument a resistance is felt at the meatus which disappears as soon as the instrument is passed further into the urethra, giving a sensation as though the instrument was passed through a rubber band, the meatus is too small and should be enlarged by incision and dilatation until the calibre of the meatus is made equal to the spongy portion of the urethra.

ABNORMAL MEATUS. In cases of deformity the meatus may be displaced and the urethra may open anywhere along the under surface of the penis, inducing a condition known as hypospadias, or it may terminate above the penis immediately under the pubic arch, when it is known as supra- or epispadias. Either condition is one of incomplete development but it can always be corrected. The object of the surgeon in both cases is to complete the urethra and secure its opening at the end of the penis, where it belongs. In operating for hypospadias the first step is to make a longitudinal incision along the bottom of the groove which marks the position of the normal urethra so as to deepen the canal. Two narrow strips of tissue are then to be removed from the margins of the groove extending from the existing meatus to the future one. The margins of this wound are now to be brought together by the aid of silver wires employed in a shot suture. The shot which rests against the surface of the penis should be split and strung so that its broad surface impinges upon the mucous membrane. The stitches should enter on either side, a quarter of an inch from the margin of the wound. They should all be introduced before any of them are tightened. In securing the sutures one side is first to be fastened and then the other. They should be drawn no tighter than is necessary to hold the edges of the wound in coaptation. The manner of fastening the sutures is to thread the split shot first and afterwards thread a

whole shot, which as soon as it is in contact with the split is to be pinched with heavy artery forceps so as to secure a firm grip upon the silver wire. The shot can then be threaded in a similar manner upon the other extremity of the wire, and while it is being tightened sufficiently to hold the lips of the wound together the upper shot can be squeezed down upon the wire and the end of the wire cut off. Whether the hypospadias extends as far merely as the upper margin of the glans penis or throughout the whole extent of the organ is immaterial. The sutures are to be placed about a quarter of an inch apart until the entire canal is reproduced. The last stitch will be in the glans penis itself.

A small piece of rubber tubing sufficiently long to extend half an inch beyond the false opening of the urethra is now to be introduced into the new urethra, where it is to remain for a week or ten days until the stitches are removed. If the margins of the wound are secured by a thread or sheep-gut or any other form of suture than silver wire the operation is very liable to be a failure. Close union attends the operation where the shot suture is employed. The tube may be removed at the expiration of ten or twelve days, after which the occasional introduction of bougies along the urethra will be necessary to maintain a proper calibre of the urethra while the part is healing, which may require a month or six weeks' time.

In operating for suprapadias as the canal is absent throughout the penis it is to be created. The glans of the penis is to be seized with the left hand of the operator while a long narrow-bladed bistoury is passed from the end of the penis along its entire length until the point of the knife appears at the false meatus. The knife is then made to enlarge the new urethra to a proper calibre. This can be ascertained by the introduction of sounds. A piece of rubber tubing should then be passed along the new urethra until it reaches half an inch or an inch beyond the original opening of the meatus, which is now to be closed. This is to be accomplished by denuding its margins and securing the wounded edges by a shot suture as in the operation for hypospadias.

AFTER-TREATMENT. As a rule no after-attention is necessary, in so far as penile wounds are concerned, if the operations are done under asepsis. If inflammatory symptoms arise aconite or ferrum phosphoricum may be required for a day or two. If painful erections follow belladonna, cannabis indica or mono-bromide of camphor may be given with benefit. Chordee will best be met by cold applications, together with mono-bromide of camphor, though other remedies may be used with benefit. In the general way the after-medication and attention are those belonging to similar surgical conditions elsewhere.

CHAPTER XIII.

SURGERY OF THE MALE URETHRA.

Surgical Conditions.—There are but two conditions of the urethra which are apt to call for surgical attention. The one is gleet, or chronic catarrh, and the other is stricture. Chronic catarrh or gleet may be a sequela of gonorrhea or be merely idiopathic. The cause of the affection is immaterial, as the same treatment is called for in either case.

So intimate is the relationship between the rectum and the sexual organs that the former should also receive attention if it is abnormal in any way. After this has been accomplished the measures at the hands of the surgeon for correcting the condition are limited in number but effective.

By the skillful employment of urethral sounds, aided by urethral injections, together with the exhibition of whatever internal remedy may be indicated, this annoying affection can be very readily overcome. Acute catarrh, whether specific or otherwise, is treated by internal medication and very mild injections. Where the condition has become chronic however, in addition to stimulating injections the employment of graded urethral sounds is indispensable. By their aid dilatation can be secured, and also the alternations of heat and cold, which are valuable adjuncts in the cure of chronic gleet.

Sounding the Urethra.—In employing sounds the urethra should first be douched and the sound selected well smeared with a fine quality of soap. With the patient in a recumbent position the operator is to seize the sound about at its centre and hold it longitudinally with the body with its beak dependent and directed toward the perineum. It is then made to enter the urethra, and while it lies parallel with the body, with nothing to separate it from the abdomen but the hand of the operator, the penis is to be well pulled up upon the sound until the instrument is level with the anterior surface of the abdomen (Fig. 689). Traction upon the organ can now cease and the sound be gently raised, when by its own weight, if properly directed, it should follow the curve of the urethra and enter the bladder (Fig. 696). When the instrument has passed beyond the point where it is at right angles to the body, sinking deeper as it is carried downward, it will then have entered the bladder and should be carried no further, as an atrophied or ulcerated bladder could easily be punctured by the extremity of the sound, and such an accident is liable to be fatal. After the sound has been passed into its full position it is then to be withdrawn and its surface inspected. If it be covered with strings of mucus it is to be cleansed, well soaped, re-introduced, and once more examined. This process is to be repeated again and again until no further mucus appears upon the instrument. After this, larger sizes can be passed until the urethra is felt to hug the sound closely throughout its entire length. Over-distension of the urethra, especially in the aged, is

apt to induce enuresis and is, consequently, to be avoided. Should this accident happen the parts can usually be restored to a normal condition by the use of fomentations, electricity, and internal medication. Equisteum, ferrum phosphoricum, pulsatilla, gelsemium and apis mellifica are among the remedies which will be found serviceable.

The sounds should always be warmed before they are passed. When alterations of heat and cold are needed to arouse reaction the hot ones should be passed first. The last one may be cooled in ice water before it is soaped and inserted. Sounds should not be left in position long, and immediately afterwards the point of the penis should be dipped in hot water and left two or three minutes so as to insure a proper degree of reaction. The use of the sounds as just described is intended to take place under an anesthetic. As a single treatment of this kind is usually insufficient for a cure medium sounds are to be subsequently employed at longer or shorter intervals at the discretion of the surgeon and without an anesthetic.

When the extended employment of the sounds is necessary for the completion of the cure a medium sized instrument is to be selected and after it is passed into the urethra it is retained in position, being held there by the surgeon or his assistant, at intervals varying from five minutes to two hours, according to the reactive power of the patient. The length of time required to secure proper reaction can be arrived at only upon repeated trials, a conservative course being always the best. If retaining a sound for five minutes produces no effect upon the case, at the next sitting, four or five days or one or two weeks later, as the case may require, the sound may be left in position for fifteen or twenty minutes. If there is still no response and the condition of the patient remains the same at the next sitting it may be left half or three-quarters of an hour. If there is still no reaction at yet another sitting it may be left in still longer, until satisfactory results follow its employment. In such cases it had best be used at bedtime, and after each sitting three times a day for two or three days thereafter the point of the penis should be held in water as hot as can be borne by the patient for a few minutes.

As long retention of the sound is apt to produce more or less shock to the patient, and as the force of the shock is most liable to be visited upon the kidneys, the patient should always be cautioned to avoid exercise, and if necessary remain in bed for a few hours or a few days, according to the susceptibility of the case, so as to avoid inducing inflammatory action in those organs.

Soap is the best lubricant to facilitate the introduction of the sounds, because it is the only one which will aid in bringing away the mucus and at the same time be sufficiently soluble in urine to be washed out of the urethra as this is passed.

Urethral Douching.—Urethral injections may be made by the aid of small syringes, which are sufficient for the outer portion of the urethra. The deep urethra may be douched either by the double douche-tube or by the aid of the catheter. When the douche-tube is preferred one of two forms may be selected, the metallic and the flexible. A double metallic tube acts as follows: The stream which passes through a small tube in the centre of the instrument is thrown against the concave extremity of the encasing tube, which directs the stream forcibly

backwards. It soon finds exit at the long slits located at the sides and further on, through the same openings, enters the return tube and is received in a proper receptacle. Another form of metallic urethral douche-tube is that of Linderschmidt. The advantage of this instrument is that its extremity is bulbous and the openings in it are directed backwards so that the debris is washed out of the urethra instead of into the



Fig. 764.
Plain Double Channel
Catheter.

bladder. As the shaft of the instrument is small in calibre the solution employed can readily escape from the urethra by its side. The tip of this instrument can be unscrewed and fastened to the extremity of a piece of rubber tubing and in this way a flexible instrument can be secured, which is preferred by some. For practical purposes the soft rubber catheter is all that is to be desired. It is smeared with soap and introduced into the bladder, and as the syringe forces whatever solution is employed through it it is slowly withdrawn in this way and the entire urethra is very satisfactorily cleansed. The urethra should always be cleansed before the sounds are employed. It is extremely hazardous to employ urethral douche-tubes, catheters or sounds in cases of acute inflammation of the urethra.

Urethral Stricture.—Strictures of the urethra may be spasmodic or organic. Spasmodic strictures result from abnormal conditions of the foreskin, meatus, frenum or prostate, but more frequently from rectal and sigmoid troubles, and pass away soon after the cause is removed. Organic strictures result from acute inflammatory action, either specific or traumatic in their origin, or from the employment of excoriating injections. They may occur at any point of the urethra. Most cases can be cured by dilation, the failure of this method being due to uncorrected rectal trouble. Urethrotomy is still favored by many surgeons, but if proper respect be had for the influence of morbid conditions located in the rectum and at the point of the penis its employment will seldom be found necessary. In treating strictures a steel sound smaller

than a No. 8 should never be used. If the calibre of the stricture is too small to permit this number to pass larger sounds should be employed, the urethra should be well dilated as far as the stricture, and there should then be made to pass the smaller sized graded bougies. If entrance can not be made with these the filiform bougies can be employed. In making use of the filiform bougies it is well to introduce three or four of them at the same time, as the presence of several serves to better expand the urethra, while one or more of those in the centre of the bundle is guided through the stricture. After the filiform bougies have been made to enter the urethra a bougie may be threaded upon a larger instrument, which can be guided over it and through the stricture. The injection of hot olive oil favors the introduction of bougies through urethral

strictures and can be repeatedly employed during the efforts at entering.

Electrolysis.—A favorite means with some surgeons in cases of urethral stricture is the dissolving of the stricture by means of electrolysis. For this purpose graded urethral electrodes and a galvanic battery provided with a milliamperemeter are necessary. As soon as the tip of the urethral electrode impinges upon the stricture the positive pole of a galvanic battery is connected with it, the negative pole resting against the lower part of the abdomen or the small of the back. The current is then turned on until a strength of from five to fifteen or twenty milliamperes is secured. From five to fifteen minutes are necessary to give the instrument a fair trial. In the hands of some surgeons this method is regarded as successful. Occasionally cases will be encountered where the stricture is too narrow, too tortuous, and too unyielding to be successfully treated without the aid of the knife. Such strictures may be located anywhere along the urethra, but their favorite location is at its membranous portion. Perineal section is the proper treatment for such extreme cases.

Perineal Section.—The patient is to be placed in the lithotomy position and the perineum shaved and cleansed. If the stricture is deeply located a lithotomy staff can be introduced as far as possible to serve as a guide in the earlier steps of the operation. Where the stricture is along the body of the penis it may be cut down upon and dissected away if the surgeon finds it necessary. Nothing but perineal section, however, will suffice for obstinate strictures of the deep urethra. The incision is to be made along the raphe in the median line. The point where the urethra hugs the arch of the pubes should mark the centre of the cut. It is not necessary to carry the incision quite as far as the anus. As the tissues are severed hemorrhage will be encountered from the transverse perineal artery a little below the point where the urethra disappears through the triangular ligament. It is easily secured by artery forceps, and is never troublesome. As the tissues are severed deeper and deeper the position of the urethra, which should always be ascertained by the sense of touch, is to be kept constantly in view and should occupy the centre of the dissection, the margins of the wound being held apart by the retractors in the hands of assistants. After the triangular ligament has been severed sufficiently to permit the introduction of the index finger this should now be passed and crowded deeply into the wound, following the hardened urethra as its guide until it impinges upon the prostate gland. As soon as this structure is felt it can be seized by a tenaculum, or, and better, by two tenacula, one placed on each side, and while it is being dragged downward and held firmly in position by assistants entrance to the bladder can be effected through the prostate by the aid of a narrow-bladed bistoury. As soon as this has been accomplished urine will escape by the side of the knife. Before the latter is removed a pair of long polypus forceps should be carried by its side into the bladder. The blades of this instrument should now be separated and between them a large sized uterine sound should be passed into the bladder. The forceps can now be withdrawn while the blades are being held forcibly apart, so as to divulse the opening through the prostate. The sound should now be removed and a piece of rubber tubing, provided with a crossbar of the same material at its upper extremity, should be carried through the

opening into the bladder. If this instrument is properly placed urine will at once pass through the rubber tubing. The hardened and obliterated urethra is now to be sought for, seized by a small vulsellum forcep or tenaculum and dissected away. Sounds should be passed along the urethra until a proper calibre of the remaining portion of the urethra is secured. The external wound can then be closed, leaving a sufficient opening around the rubber tubing, through which the deep part of the wound can be carefully packed with iodoform gauze. The external wound can then be dressed and the patient be placed in bed. A short glass tube can be inserted half way into the rubber tubing which enters the bladder and the outer half can be covered by a long tube, the other extremity of which is passed into a receptacle by the side of the bed. Extravasation of urine will not take place, as the drainage of the bladder is perfectly secured by the closure of the bladder sphincter about the tubing which has been left in the wound. The packing should be renewed twice a day, and the glass tube should be pulled from the rubber so that the bladder may be thoroughly irrigated with boracic acid solution at each sitting.

Hypodermic injections of morphine in such cases will counteract the shock and prevent suppression of the urine, as well as render the patient comfortable. It will not be necessary after the first twenty-four or forty-eight hours. The tube should be left in position for a week or ten days after which it can be removed. The patient will then pass urine periodically through the opening in the perineum. In the course of a few days, however, as this wound closes, the urine will begin to appear through the natural channel. Before it is entirely closed it is better to begin the use of sounds, which should be employed as often as once in two or three days and continued for a few weeks, until the new urethra has cicatrized sufficiently to insure against a reproduction of the stricture.

MEDICATION. It occasionally happens that even so simple an operation as sounding the urethra is attended or followed by a decided degree of reaction, known as surgical fever of the urethra, which will require the exhibition of aconite, belladonna, gelsemium or ferrum phosphoricum. In sharply defined cases aconite, in the second dilution, best meets the indications, usually controlling the febrile symptoms promptly. If the congestion is extreme belladonna will do better. Cold applications to the organ will also be useful, and perhaps hot water injections into the urethra will be required.

In sounding or otherwise operating upon the urethra cocaine should be used within the canal with caution, if at all. It is readily absorbed, and dangerous narcosis has been induced by the use of a four per cent. solution in sensitive subjects.

CHAPTER XIV.

SURGERY OF THE ORIFICES OF THE FEMALE SEXUAL SYSTEM.

Division.—Under this heading must be considered conditions of the hood of the clitoris, the labia minora and majora, the orifice of the urethra, the entrance to the vagina, the vaginal canal, and the uterus.

Clitoris.—The clitoris corresponds to the point of the penis, and its hood to the foreskin. The clitoris itself seldom requires attention. The hood, however, is a frequent source of irritation and needs the attention of the surgeon. It differs from the foreskin in that it does not completely surround the clitoris, simply covering it like a gabled roof. Like the foreskin, however, it may deviate from a normal standard in two particulars. It may be redundant and require amputation, and it may be phimosed, hugging too closely the structure of the clitoris. It is exceedingly common to find it adherent to the clitoris and confining more or less smegma, even where it is of proper length, and should always be loosened and the part thoroughly cleansed. Where the hood binds the clitoris too tightly all that is required is a dorsal slit to permit its lips to part and free the clitoris from the undue pressure which has been exercised upon it. The angles of the lips which are thus made may be clipped away and one or more stitches of fine sheep-gut taken to hold the skin and mucous membrane together for healing purposes.

An elongated or hypertrophied hood should be amputated. This is to be accomplished as follows: The centre of the free margin of the hood is seized with a pair of plug forceps, applied longitudinally. While the assistant is employing gentle traction with the forceps in directions at right angles to the body the surgeon by means of a pair of scissors clips away the redundant tissue. In doing this two points must be observed. The entire hood should never be clipped away, as the subsequent cicatrization would constrict the clitoris. A narrow margin of mucous membrane is therefore to be left unmolested over the entire circumference of the hood. In severing the tissue at the point of seizure by the forceps the cut should be made close to the tip of the forceps, as otherwise too much integument is liable to be removed and the eversion of the stump of the hood which would result is not desirable. A continuous suture of fine sheep-gut should coapt the severed margins of the skin and mucous membrane, care being taken not to pucker the tissues.

Labia Majora.—These are frequently the seat of fistulous tracks, hypertrophied, sebaceous glands and lymphoma. The use of the knife is the most satisfactory way of exterminating these conditions.

Eczema.—When the female pudenda is afflicted with eczema it usually involves the hood of the clitoris, the labia minora and the labia majora. The trouble is a reflex one and will disappear upon the correction of the morbid conditions found at the clitoris, the urethra, the orifice

of the vagina, the uterus, ovaries and tubes, and the rectum. Temporary relief is often required, however, and may be secured by the aid of blue ointment, a mixture of carbolic acid and olive oil, in proportions of one to three, solutions of nitrate of silver, carbolic acid or bichloride of mercury, and the application of various salves, among which are to be mentioned taroid, calendula cerate, and benzoated oxide of zinc ointment.

Labia Minora.—The labia minora are frequently sources of irritation by virtue of their abnormal length and irritable margins. Where they are so extremely elongated as to be rubbed between the thighs in walking (Hottentot apron) they should be amputated. Where they are of normal length and present ragged, irritable margins, these can be clipped away without materially shortening the labia.

In amputation of the labia minora it is better to sever them even with the surface of the vulva. In doing so two points of hemorrhage will be encountered on either side from terminal branches of the internal pudic artery. One branch will be located midway on the vulva, and the other will be near the clitoris. These should be immediately seized with artery forceps, and as the wounded margins of the mucous membrane are brought together by a continuous suture a loop of the thread can be thrown around each artery, and as the thread is tightened the hemorrhage will be effectually controlled.

Orifice of the Female Urethra.—This should be smooth and dilatable. The abnormalities which it may present for the surgeon's consideration are a too narrow meatus, a roughened margin, enlarged mucous glands, varying in number from one to half a dozen, located laterally and inferiorly, and urethral caruncles. When the meatus is too narrow it should be enlarged by dilatation. This can be accomplished by the employment of uterine graded sounds, or by polypus or artery forceps introduced while they are closed and then opened to a desirable degree. The margin of the urethra is frequently ragged, especially in young women, and should be smoothed with a pair of scissors, all sharp-pointed elongations of mucous membrane being clipped away until a normal condition is secured. The enlarged glands frequently encountered in this locality are a great source of mischief, being a common reflex cause of kidney and bladder affections. They are hypertrophied mucous glands, which should be microscopic in their normal state, and when they become sufficiently dilated to attract the attention of the surgeon are pathological and should be excited.

Excision. This can be accomplished by the aid of a small blunt hook or tenaculum and scissors, or by means of a hysterectomy knife. Their commonest locality is close to the margin of the meatus on either side, but they often completely surround the meatus, in numbers varying from two or three to half a dozen, and sometimes are found laterally just outside the attachment of the hymen. They may be very shallow or an inch in depth. When they are deep and the tissues about them redundant, after their removal the margins of the wounds produced may be coapted by fine sheep-gut sutures. As a rule, however, no suture will be necessary. Hemorrhage produced by operations about the urethra and labia minora should always be thoroughly controlled before the operator leaves the case, as excessive hemorrhage is of common occurrence where this point has been neglected.

Urethral Caruncle.—This is a nodule of hypertrophied mucous membrane and vascular structures protruding from the orifice of the urethra at its lower part. It is to be seized by a tenaculum or plug forcep, well drawn out, and removed at its base by the aid of a scalpel or scissors. Its cause is usually reflex, and the original trouble can in most cases be located in the cervical canal. The mucous membrane lining the orifice of the urethra is sometimes so hypertrophied and eroded and protruding that satisfactory results can only be obtained by amputating its lower extremity.

TREATMENT. When this operation is decided upon the urethra is to be held open by a slit an inch in length along its under surface. The lips of the wound are to be held apart by “T” forceps. The mucous membrane is then to be amputated, and after the wound has been stitched together by a continuous suture of fine sheep-gut the slit in the urethra may be closed in the same manner.

Hymen.—A normal hymen has a smooth margin, an ample opening for the introduction of finger or speculum, and is free from irritation. When in such condition it should be permitted to remain unmolested. It is, however, frequently ragged along its free margin, irritable about its base, and frequently so nearly closed at its orifice as to prevent exploration of the vagina. When it presents any of these conditions its entire removal should be accomplished.

EXCISION. This can be done by seizing it in three or four places by “T” forceps and with a pair of scissors amputating it on a level with the surface of the vulva. Care must be taken not to cut deeply by the side of the urethra, as the terminal branch of the pudic artery lies immediately beneath it and profuse hemorrhage will be encountered if it is severed. The hemorrhage from a carefully amputated hymen is inconsiderable, and in a majority of cases no stitching will be required. Where, however, the tissues are hypertrophied and vascular it is well to employ a continuous suture to close the wound.

Ostium Vaginæ.—This point is marked by the position of the hymen. It is sometimes abnormally contracted, sometimes abnormally relaxed, and in childbirth is frequently torn. Contraction occurs in children and unmarried women, and is productive of a host of nervous conditions, which speedily disappear when the part is relieved of its irritation and properly dilated.

TREATMENT. There is no more satisfactory instrument for divulsion of the vulva than the bivalve rectal speculum. All trimming of the hymen, and roughened margins of the vaginal mucous membrane should be accomplished before the dilatation is practiced. When the opening of the vagina is found to be in an abnormally relaxed condition it is due to a weakened nervous system, which permits a paralytic condition of the muscles guarding the opening. The parts can be stimulated and restored to a proper tonicity by dilatation and electricity, periodically applied, by the removal of other pelvic lesions, the correction of objectionable mental and bodily habits, and general measures which increase the vitality of the patient. Such cases usually present a pale, atrophied condition of the sexual organs and an obstinate form of uterine catarrh. A proper treatment of the endometrium, which will be considered later on, is indispensable to a cure.

CHAPTER XV.

LACERATION OF THE PERINEUM.

Varieties.—There are three forms of laceration of the perineum to be considered: incomplete, complete, and sub-mucous.

The incomplete laceration describes the condition where the perineum is torn as far as the rectal sphincters. By the complete form is meant the deeper laceration which involves the rectal sphincters and more or less of the walls of the vagina and rectum. By the sub-mucous variety is meant the rupture of the perineal tissues without injury to the mucous membrane which covers them.

The perineum should always be examined by the obstetrician immediately after delivery, and if it is found lacerated it is better to coapt the ruptured tissues immediately. As the parts are swollen and more or less bruised they are also benumbed and their ragged margins can be smoothed without distress to the patient. The coapting sutures should be placed at some distance from the margins of the wound, as the tissues are all softened by the bruising and maceration which they have undergone and superficial ones are apt to cut through. Where the operation is undertaken within a few hours after the injury sheep-gut sutures may be employed. A few deep interrupted ones should be taken, and the margins can be brought together by a continuous suture so as to close the wound tightly against the vaginal discharges.

Incomplete Laceration of the Perineum.—A rent of this nature may be repaired as follows: With the patient anesthetized and placed in the lithotomy position, the parts having been previously prepared, inspection should be first made to ascertain the amount of rectocele which the case presents. The centre of this prominence, which is usually situated an inch and a half or two inches above the margin of the lacerated perineum, is to be seized by a pair of "T" forceps, which are passed to the hands of an assistant. A small nick should now be made with knife or scissors on either side of the vulva half way between the wound and the meatus so as to mark definitely the position of the anterior margin of the new perineum. The operator then inserts the index finger of his left hand, with its palmar surface upward, into the rectum until its point rests immediately beneath the attachment of the "T" forcep, which seizes the summit of the rectocele. While the assistants are holding the labia apart the operator seizes a long, sharp-pointed, straight, narrow-bladed bistoury, which he enters at the posterior fourchette of the



Fig. 765. Little's Lithotomy Bistoury.

perineum right where the skin and cicatricial tissue are united, the cutting edge of the knife being directed to one side, so that its flat surface is held parallel with the finger which is inserted in the rectum. The knife is now pushed upward in the direction of the "T" forcep,

which are gripping the summit of the rectocele, splitting the partition between the rectum and the vagina, care being taken not to penetrate into either passage. The knife can then be withdrawn. A pair of sharp-pointed scissors are now to be employed to sever the mucous membrane from the skin on either side, beginning at the puncture made by the knife and ending at the niches located at either side of the vulva. The scissors are then to be closed and pushed into the partition between the vagina and rectum in the track made by the knife. After their point has been carried upward as far as the knife penetrated the blades can be separated, and, while held firmly in this position, withdrawn, thus tearing apart the areolar tissue which separate the structures of the rectum from those of the vagina. At the lower part of the wound the dissection should be completed by the scissors as far as the niches on either side. The operator has now split the partition between the rectum and vagina; the completion of the operation consists in raising the vaginal flap as a roof and coapting the wound surface beneath it. This is to be accomplished as follows:

The lower margin of the vaginal flap is to be seized by three "T" forceps, one placed centrally and the others at either side, by means of which the roof can be raised by the assistants. While it is held in this position the wounded surfaces are to be coapted. This can be done in a variety of ways, all of which have points in their favor. The sutures may consist of silk, sheep-gut, silk-worm, kangaroo-tendon, or silver wire. The material usually preferred is either silk-worm or sheep-gut.

FIRST METHOD. As the sphincter vaginae and transversus perinei muscles have been torn apart by the laceration and as prolonged traction has shortened them, it is important that their extremities should be reunited. They are located deeply, just within the vagina, and their thickened, severed extremities can be readily felt by the operator. A heavy sheep-gut suture should be employed to reunite these ruptured muscles. One stitch is sufficient if the knot be properly secured. As this is the main point to be secured in the operation all that remains to be done is to carefully coapt the margins of the skin and mucous membrane with a continuous suture of sheep-gut. This is to be accomplished by commencing the seam at the anus. As soon as the stitch has progressed as far as the niches on either side in the middle of the vulva, at the point where the vaginal roof becomes continuous with the integument, the remaining wound can be closed in one of two ways: The seam which brings together the margins of the wounded integument can be continued on upward and bring together the margins of the vaginal roof, which will afterwards appear just inside as a projecting teat of mucous membrane. Perhaps the better way, however, is to seize the lower edge of this vaginal flap and, drawing it downward as far as it will come easily, amputate all that is redundant. The severed margins can then be puckered down to the margins of the integument still remaining uncoapted and the thread fastened.

SECOND METHOD. A second and satisfactory way of closing the perineum is as follows: Two rows of sutures, one deep and the other superficial, are to be employed. The deep sutures are to be interrupted and to consist of silk or No. 24 silver wire. The superficial one is to be a continuous suture or sheep-gut, similar to that employed in the method just described.

The manner of employing the deep suture is as follows: With the index finger of the left hand introduced into the rectum and curved forward, so as to spread the wound in the vulva wide apart, a large sized threaded perineum needle is to pierce the integument on a level with the upper margin of the anus about an inch from the edge of the wound, and is to be carried across the wound, being completely covered throughout its course and made to effect its exit on the opposite side at a point symmetrical with its entrance. The point in holding the finger inserted in the rectum during the insertion of the stitch is to enable the operator to guard against piercing the rectal mucous membrane while he is burying the needle. Half an inch higher another stitch is to be similarly placed. A third stitch is now to be employed at a point which is to mark the anterior boundary of the perineum, the stitch being placed with the view of coapting the angles of the wound right where the lower edge of the roof, which has been dissected upward and the skin become continuous. This stitch is not to be buried, but simply to have a deep grip upon the skin and muscular tissue underneath it. It is to take the place of the deep sheep-gut suture in the previous method.

The wound is to be thoroughly cleansed from all blood-clots, and the superficial stitches, which are to hold together the margin of the wound, are to be introduced by the method just described. The deep stitches are now to be fastened, care being taken not to pinch the tissues unnecessarily. In case the wire suture is employed, after it has been tightened to a satisfactory degree by the aid of two tenacula, the wires are to be bent at right angles where they enter the skin so as to lessen the pinching of the integument. Where silk is employed this proceeding is, of course, unnecessary owing to the flexibility of the material. The disadvantage of this manner of stitching is the pain which the patient suffers while the stitches are retained in position.

Another method of coapting the surface of the wound is newer, and if it proves as reliable in all cases as either of the previous methods will undoubtedly become the favorite. The superficial stitching in this method can be made of sheep-gut as in the methods just described. This method differs from the others in the manner of applying the deep sutures. Silk-worm suture is perhaps the best material for carrying it out. The stitches are to be buried as in the second method described, but they are not to penetrate the skin. They are to be inserted deeply into the tissues from side to side, beginning and ending close to the severed margins of the integument, care being taken not to penetrate it. They are buried throughout their course so that when they are tightened they hug together closely, like a puckering string, the tissues which surround the wounded surface, but do not impinge in the slightest degree upon the integument. Three or four of these sutures, placed about a quarter of an inch apart, will suffice for most cases. A superficial suture of sheep-gut, as suggested in the previous method, is now to be employed to coapt the edges of the integument. Even these can be introduced beneath the skin rather than through it, so that it is not necessary to penetrate the skin at any point. The chief advantage of this method of closing the wound lies in the small amount of pain which the patient subsequently experiences.

The flap operation as just described has for many years been a



Figure 1. Laceration of the Perineum to the Sphincters.



Figure 5. Nicking Sides of Vulva to Limit Lateral Margins of Denudation.



Figure 2. Transfixing Vagino-Rectal Septum with Long Narrow-Bladed Scalpel.



Figure 6. Splitting Vagino-Rectal Septum to Form Vaginal Roof.



Figure 3. Wound Prepared for Closure.



Figure 7. First Stitch.



Figure 4. Wound Ready for Securing Stitches.



Figure 8. Operation Complete.

favorite with prominent operators, its supposed advantage consisting in its ability to protect the wound from the vaginal discharges and thus favor union by first intention.

Since the introduction of antiseptic methods in surgical practice, however, as much stress is not laid upon this point as formerly, and as a result it has become the common practice to remove the vaginal roof after it has been dissected up and close the wound in the vagina by superficial and deep sutures carried from side to side in the same manner as those employed in the outer part of the wound.

Complete Rupture of the Perineum.—It matters not whether the wound be simply through the sphincter or whether the laceration extends well up into the partition between the rectum and the vagina, the principles of the operation are identical. In such cases the recto-vaginal septum is to be split in the same manner, as just described, as the first step in operating for the incomplete rupture.

The first step of the American operation is now to be performed, that is the last inch of the rectum is to be denuded of its mucous membrane. As the ruptured sphincters are uncovered they will be found in all cases to be atrophied and retracted. Their severed extremities are to be seized with tenacula, and while these are held by an assistant they are to be severed on either side close to their posterior junction. The mucous membrane of the rectum is now to be seized by "T" forceps, as in the American operation, drawn down, the longitudinal fibres loosened, and the muscular tissue pushed upward. While the forceps in the hands of an assistant are prolapsing the rectal mucous membrane as far as the severed margins of the integument the ruptured ends of the sphincter muscles are to be re-united by sutures of heavy sheep-gut. Two or three heavy silk sutures are now made to coapt the two sides of the perineum. The American operation is then to be completed, and the remaining wound in the perineum is to be closed after one of the methods just described.

The object in performing the American operation in connection with the operation for the restoration of the perineum is to avoid the danger of a recto-vaginal fistula and to insure a successful union of the parts. The operation, performed skillfully after this manner, should not be a failure.

Sub-Mucous Laceration of the Perineum.—These cases are not as rare as they are unrecognized. The vulva gaps widely, permitting prolapsus of the vagina and rectum. The ends of the ruptured and retracted muscles beneath the mucous membrane can be felt on either side. The skin is to be severed from its junction with the mucous membrane, the vaginal roof raised, the severed extremities of the muscles found and united by sheep-gut ligatures, and the outer wound closed.

Deep stitches in all forms of perineal operation, except when the operator has employed sheep-gut, are to be removed on the eighth, ninth or tenth day.

The patient should be kept on liquid diet a few days before the operation and the bowels well emptied. The bowels should not be confined with opiates, but left unmolested as long as they consent to remain quiet. When nature demands their evacuation her order should be respected, and it should be accomplished after the manner described in the chapter upon the rectum.

CHAPTER XVI. SURGERY OF THE VAGINA.

Surgical Conditions.—There are four conditions of the vagina which call for surgical attention. These are occlusion, vaginismus, hardened papillary growths, and redundancy.

Occlusion.—Occlusion of the vagina may be partial or complete. It may be located near the vulva, but more commonly is encountered at the lower extremity of the cervix uteri. Cases of complete occlusion of the vagina have been mistaken for malformation in which there was an entire absence of the uterus and its appendages.

TREATMENT. Whether the occlusion be complete or incomplete an opening is to be made in its centre sufficient to introduce the index finger of the operator. The strictured condition is then to be incised in three or four places, as the cases which are merely dilated are prone to recur. Incision is accomplished by the aid of a sharp-pointed curved bistoury, transfixing the stricture at its base under the guidance of the index finger, which is introduced through its opening. A stitch is to be placed at the bottom of each incision, bringing together the points of entrance and exit made by the point of the knife in each case. In this way the wound will be closed and the calibre of the vagina restored to its normal condition. The edge of the stricture between these points can be seized by plug forceps and cut away if necessary, and the wounded margins brought together by sheep-gut sutures. A still simpler method is to remove the entire stricture by dissection and to suture the wound.

An adhesion of the upper part of the vagina to the cervix, especially in elderly women, is by no means an uncommon occurrence, resulting from excoriation of the sulcus about the cervix and subsequent cicatrization. Such cases present the appearance of an absence of the cervix, and are frequently reported as such. If the patient presenting this condition is in a fair degree of health the part should be permitted to remain undisturbed. But if the impingement of nerve fibres caused by the adhesion is considered a factor in whatever unhappy state she may be found, the vagina can be dissected from the cervix and by repeated treatments can be kept back until the parts involved are restored to such a normal condition that the trouble is not liable to recur.

Vaginismus.—This painful and annoying affection consists of a spasmodic action of the circular fibres of the muscular coat of the vagina, and is usually reflex from abnormal conditions of the clitoris, vulva, endometrium or rectum.

TREATMENT. It is to be treated under an anesthetic, and whatever neighboring difficulties are encountered are to be corrected. The uterus is to be dilated, curetted and packed. The hymen and urethra are to be properly repaired, the hood of the clitoris is to be loosened, and amputated if necessary, the rectum is to be relieved of its pockets, papillæ, or hemorrhoids and other pathological conditions presenting, and, last of all,

the vagina is to be thoroughly dilated by the aid of the rectal bivalve and packed to its capacity with iodoform-gauze. The patient is to be kept under the action of morphia or some other anodyne so that the vaginal packing can be permitted to remain for at least forty-eight hours, after which it is to be removed and re-applied daily until the irritable condition is entirely overcome. The uterine packing is to be removed at the end of forty-eight hours, when the first vaginal packing is taken away.

Hardened Papillary Growths.—In unmarried women as the surgeon introduces his finger into the vagina for purposes of exploration, more or less of the vaginal surface is sometimes found to be so rough and hard as to suggest a tube lined with very coarse sand-paper. Oftentimes this roughened condition is characteristic of the vagina throughout its extent. More frequently it is limited to the lower part. The point most commonly affected and presenting the coarsest and roughest granulations is situated under the urethra near its orifice. This roughened and leathery condition of the vagina is not consistent with the general health and happiness of its possessor. It can be corrected by giving proper attention to whatever other pelvic work may be disclosed upon inspection to be necessary, and by the aid of tenacula and scissors and by dilatation and curetting.

TREATMENT. The first treatment of the parts should be made under an anesthetic, and should be thorough as possible. In cutting away the growths with tenacula or plug forceps and scissors it is not necessary to wound the basement membrane of the vagina, but simply to smooth its surface.

The condition does not readily yield to treatment, and systematic dilatation, injections and local applications will be required to overcome the difficulty and restore the membrane to its normal smoothness and flexibility. Douchings medicated with hydrastis, thuja occidentalis, carbolic acid, or hamamelis are serviceable. The spots where the accumulation of these warty growths are continuous may be touched with chromic acid or ninety-five per cent. carbolic acid, at the discretion of the surgeon. Dilatation to the extent of tolerance should be employed by means of the bivalve rectal speculum once or twice a week. A prescription that is often serviceable in softening down the hardened membrane is made of glycerine and hamamelis, each four ounces, and of oil of eucalyptus four drachms, mixed. A long pledget of cotton is to be soaked in this mixture, smeared with vaseline, and introduced into the vagina two or three times a week until the part is well softened. Afterwards the vagina can be dilated and packed with iodoform-gauze and douched until the normal condition of the mucous membrane is completely restored.

Redundancy.—This usually occurs in women who have borne children, and is due to over-distension of the vagina and the consequent weakening of its muscular fibres. It is a harmless affection unless it be accompanied with prolapsus uteri or cystocele or rectocele, or all combined.

TREATMENT. In mild cases local tonics, dilatation and electricity, together with the repair of the cervical and perineal lacerations when they exist, and sexual abstinence, are sufficient to effect a restoration of tonicity. Plastic operations, however, are essential in aggravated cases to a restoration to a normal condition. When cystocele is present the

mucous membrane is to be removed from the entire surface of the existing protrusion from the cervix to the urethra. The shape of the piece removed may be circular, elliptical, or heart-shaped. In closing the wound sheep-gut sutures may be employed, and a careful coaptation of its margins from side to side is better than buried sutures, as these interfere less with the circulation of the part and the wound is more apt to heal by first intention than where deep sutures are introduced.

Rectocele is usually an accompaniment of laceration of the perineum, and is to be corrected when the perineum is repaired by denuding as much of the vagina as is necessary to remove the redundancy. Where the cervix is also lacerated—and this is usually the case—it should be repaired at the same sitting, sheep-gut sutures being employed to close the wound so as to avoid the necessity of removing the stitches.

COMPLICATIONS. Extreme cases of vaginal redundancy and relaxation, especially when accompanied with sub-involution of the uterus and retroflexion, not only present well pronounced cases of cystocele and rectocele but also all degrees of prolapsus uteri, even to procidentia. When this condition prevails in women who are still in the child-bearing period it can be corrected in two operations. The first one is a celiotomy, or abdominal section by means of which ventral fixation is accomplished. The second operation is to dilate and curette the uterus, repair the laceration of the cervix, and remove redundant tissue from the under surface of the bladder, from the surface covering the rectum, or from both, as the case may require. A third operation in such cases may be needed to close the perineum. In strong, well-nourished women, however, the perineum may be closed at the same sitting, sheep-gut sutures being employed in the trachelorrhaphy and colporrhaphy. The amount of wounded surface which can safely be visited upon the patient at one time must depend upon her general condition, and also upon the condition of nutrition in which the parts are found. If the parts are pale and anemic nature must not be presumed upon and the work had better be done by piece-meal than to attempt to accomplish too much at a single sitting. Where, however, in addition to general health the mucous membrane is normal in color and well nourished whatever is necessary to be accomplished can be easily done at a single operation.

Procidentia.—When women have passed the child-bearing period, and the mucous membrane is pale, atrophied and anemic, and the parts are so lax as to permit cystocele, rectocele and procidentia, the safest and most satisfactory operation is a combined hysterectomy and colporrhaphy which denudes the under surface of the bladder and the surface of the rectum, leaving a narrow strip of mucous membrane on either side, the full length of the vagina, undisturbed.

OPERATION. The operation is to be performed as follows: After the patient has been anesthetized and placed in the lithotomy position the external parts are to be shaved, scrubbed and bathed in ether, alcohol and a solution of bichloride of mercury, one to four thousand. The vagina is then to be soaped and douched, first with Bovinine and then with peroxide of hydrogen and then with a bichloride solution, after which it is to be thoroughly dried with sterilized gauze. The cervix uteri is to be transfixed anteriorly and posteriorly by silk or gut guys. The uterus is to be dilated with graded sounds, curetted and packed. By

traction upon the guys procidentia is to be induced, and while in this position the mucous membrane is to be removed from over the bladder and the rectum is to be carefully outlined with scissors. The denudation of the under surface of the bladder should be carried anteriorly to the meatus. Posteriorly it should proceed as far as the cervix. The shape of the posterior denudation should be that of a clover leaf, while the mucous membrane removed from the under surface of the bladder should be elliptical in form. Denudation should begin at the meatus and be

carried backward as far as the cervix. Denudation of the rectum should begin at the perineum and be carried to a corresponding height. The two pieces of mucous membrane

which have thus been removed may be left unmolested at their attachment to the end of the cervix. By the aid of the blunt end of a hysterectomy knife (Fig. 766) the areolar tissue about the cervix is to be broken through until the cervical tissue is encountered. In dissecting upward the dissection should be made circular, hugging the uterine tissue closely in every part. There is no danger of wounding bladder, ureters, blood vessels or rectum if this direction is carefully followed. After the dissection has proceeded above the internal os the surface of the peritoneum at its reflection in front and behind will soon be encountered and should be opened. After this has been accomplished, and the opening in both situations enlarged until the margins of the broad ligaments are encountered, the body of the uterus can be anteverted by means of tenacula until its fundus is made to protrude into the vagina. This will prolapse the ovaries and tubes, also, which can be dissected away from their attachment to the broad ligaments, proceeding from their outer extremities toward the uterus and confining the dissection in either case close to the tubes and the ovaries and their ligaments. The remnants of the broad ligaments can then be dissected away from their uterine

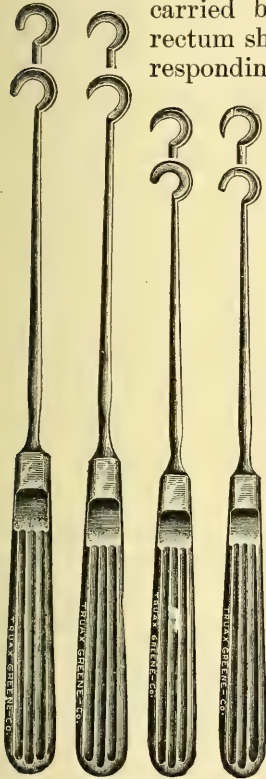


Fig. 766.

Author's Hysterectomy
Knives.

attachment; the removal of the organs will have been accomplished quickly and successfully, and the redundant vagina, uterus, ovaries and tubes will be obtained as a single specimen of careful dissection (Plate XXVIII, Fig. 1). The severed margins of the peritoneum are now to be secured by "T" forceps, and by a continuous suture of sheep-gut puckered together. The wounded margins of the vagina are then to be united, except at the vault of the vagina, where a sufficient opening is to be left for the insertion of a small amount of iodoform-gauze for purposes of drainage.

This operation was first performed in this manner by the author at Fabiola Hospital, Oakland, California, through the courtesy of Dr. Ward, through whose kindness also the specimen was photographed and forwarded. A similar operation was performed in Denver, at the 1894 meeting of the American Institute of Homeopathy.

CHAPTER XVII.

CYSTIC DEGENERATION AND EROSION OF THE CERVIX.

Surgical Relations.—The conditions of the uterus calling for surgical consideration in this connection are cystic degeneration and erosion of the cervix, endometritis, cervical and corporeal laceration of the cervix, uterine polypi, and the more serious conditions of uterine pathology demanding vaginal hysterectomy.

Cystic Degeneration.—Cystic degeneration of the cervix is common both in single women and those who have borne children. It may occur at a single point in the lower extremity of the cervix, or it may characterize the entire extremity of the cervix and also the cervical canal. Degenerative cysts are not found in the body of the uterus. Their extermination is demanded, and easily effected.

TREATMENT. A sharp-pointed, curved bistoury and a tenaculum are all the instruments required to evacuate their contents and obliterate them. Where their existence is suspected along the cervical canal the cervix should be split from side to side and the lips of the uterus thus formed held apart by guys while the operator, by the aid of tenacula, scissors, scalpel, or curette accomplishes their extermination. The lateral wounds in the cervix can then be closed.

Erosion of the Cervix.—Erosion of the cervix is likewise a common affection, and likewise occurs in single women and also in those who have borne children. When it occurs in single women it varies in its extent from a mere undue redness at the external os to an excoriated condition which may cover the entire surface of the lower extremity of the cervix, and in occasional cases proceed around the outer surface of the cervix as far as the vaginal sulcus which surrounds its base. Where the condition is encountered in women who have borne children it is usually accompanied by laceration of the cervix and hypertrophy and ectropion of the cervical mucous membrane. The vaginal surface of the cervix is very rarely affected in such cases, and when it is indicates a tendency to carcinomatous changes. Erosion of the cervix in single women is usually occasioned by an acrid form of intra-uterine catarrh, which is usually confined to the cervix but may involve the lining of the body of the uterus as well. The external and internal os in such cases may be either stenosed or abnormally patulous, more frequently the latter. As soon as the catarrhal condition is cured the erosion of the extremity of the cervix will speedily disappear. The existence of erosion of the cervix is usually in enervated women who are weak mentally, emotionally and physically. It is of exceedingly common occurrence in cases of insanity in single women. The uterine tissue is always soft, flabby and anemic. The cervix may be conical and elongated, or club-shaped and shortened. In obstinate cases where it fails to respond to well directed intra-uterine treatment, to be described, and the removal of all forms of irritation from terminal nerve fibres distributed in the pelvic region, as a last resort the lower extremity

of the cervix may be amputated. Where the condition accompanies retroflexion of the uterus if amputation of the cervix is demanded it should be preceded by some form of operation to correct the retroflexion. Ventral fixation or Alexander's operation may be employed, or if it is preferred an opening may be made in the anterior portion of the vault of the vagina close to the cervix, through which the bladder and lower portion of the reflexion of the peritoneum can be separated from the uterine tissue, and the body of the uterus flexed forward by the aid of tenacula and then stitched to the base of the cervix with sheep-gut sutures applied on either side, after which the vaginal wound can be closed. If ventral fixation is practiced no further operative interference should be made in the case at the same sitting. Alexander's operation, however, can be safely performed at the same sitting with amputation of the cervix, as can also the simple operation just described for inducing antelexion.

AMPUTATION OF THE CERVIX. After the patient is anesthetized, placed in the lithotomy position, and the parts are prepared for the operation the cervix is brought into view by the aid of a Sims' speculum and retractor. It is seized in front by a double vulsellum or a tenaculum, which serves to steady the organ while guys are being introduced. Traction is now made in diverging lines by means of the guys. The uterus is to be dilated, curetted and packed with antiseptically prepared candle-wicking or iodoform-gauze. If candle-wicking is employed, after the uterine cavity is nearly filled the wicking is to be cut off and the ends of the threads tied together with a piece of silk, after which the amputated extremity of the wicking is to be crowded well into the uterine cavity. With a pair of straight scissors the cervix is to be slit on either side to the extent of half or two-thirds of its length. Traction upon the guys can then separate the two cervical segments and expose to view the cervical canal. When it is roughened by papillary growths or studded with cysts, as is frequently the case, especially just below the internal os, the parts are to be smoothed with tenaculum, scissors or curette. The operator is now to seize the lower guy in his left hand, directing the palm downward while the index finger passes behind the cervix. By such traction and with a slight flexion of the finger the upper segment of the cervix can be rendered tense and conspicuous. With a pair of sharp-pointed scissors the cervical mucous membrane is to be amputated just above the location of the external os, the cut beveling the attached surface of the membrane. The palm of the hand which holds the upper guy is now directed upward and the index finger of the same hand made to impinge upon the cervical surface of the upper segment. Traction upon the guy will now throw the vaginal surface of the upper segment into prominence. The scissors are then to sever the vaginal covering of the upper half of the cervix. The line of amputation should be semi-lunar, its convexity directed below. Its centre should be close to the insertion of the guy, and its extremities should be directed to the bottom of the lateral slits. The amputation between these two points should be symmetrically curved. No beveling is required as the parts are flexible. A plug forcep (Fig. 773) is to seize one extremity of the segment which has been outlined by the track of the scissors and which is to be amputated, and while traction is being made upon it it is to be cut away with scissors, care being taken to make the blades of the instrument hug the bottom of the wounds already

made in marking out the doomed tissue. A pair of blunt-pointed, double-curved scissors, (Fig. 767), is well adapted to this purpose. A few spurting vessels will be encountered, which may require the temporary application of artery forceps. As a rule, however, no artery forceps will be needed. A tenaculum should now transfix the wounded margins of the



Fig. 767.
Pratt's Improved
Scissors.

vaginal mucous membrane at its centre, and while traction is being made upon it a short curved needle threaded with No. 2 sheep-gut is passed through it. The stitch should penetrate no deeper than the mucous membrane, as it is possible by deep stitching to wound the bladder, which would add an unnecessary complication to the operation. The tenaculum is then loosened, passed into the cervix, turned upward, and buried in the upper part of the cervical mucous membrane half an inch from its severed margin. As the cervical mucous membrane is always more or less friable it is necessary to avoid inserting the tenaculum close to the wounded margin. The needle should now be made to transfix the centre of the cervical mucous membrane, entering at the wounded surface and coming out half an inch higher in the cervical canal. The thread should then be tied, and the first stitch is complete. Its ends should be three or four inches in length, so that they can be employed as a guy, the upper one having disappeared with amputation. A pair of artery forceps can be fastened to their free extremity to simplify manipulation. The lower segment of the cervix is to be amputated in a similar manner, and to be likewise provided with a central stitch, which is to act as a lower guy.

If the amputated extremity of the cervical mucous membrane be inspected its base will be observed to be too large for the formation of a satisfactory external os. A "V" shaped piece of the cervical mucous membrane is therefore to be removed from either side by the aid of tenaculum and knife or scissors, the points of the two segments being directed upward. The cervical mucous membrane at the external os should not be more than a quarter of an inch in width. Artery or polypus forceps should next be passed into the uterine cavity and the lower extremity of the packing brought out of the cervical os and carried to one side. The wounded surface should be thoroughly douched to secure the removal of clots, and the wound on either side can then be closed with interrupted sutures. The first stitch on either side of the centre had better be of No. 27 silver wire or silk-worm suture. One or two additional stitches on either side will be required, and may be of sheep-gut. The wire stitches should be placed first and inserted in such a manner as to carefully coapt the extremity of the wound on either side. They should enter the vaginal mucous membrane a quarter of inch from its wounded margin and should not pierce the cervical tissues, and by the aid of two tenacula should be bent at right angles at the points where they enter the mucous membrane. After all the stitches have been placed the long

ends of the cervical stitches which were employed as guys are to be severed within half an inch of their knots. The vagina and the cervical stump are to be cleansed and dried and a fluffed strip of iodoform-gauze placed against the wound, when the operation is complete. At the same sitting the hood of the clitoris, hymen, orifice of the urethra, and rectum should be examined and receive whatever surgical attention is needed.

The gauze should be removed from the vagina on the second or third day. No vaginal douching will be required unless suppuration supervenes. The operation is not a severe one, should always result satisfactorily, and add greatly to the general health of the patient. The erosion does not reappear, and in a few months all traces of operative procedure disappear and the parts present a perfectly normal aspect. This operation does not prevent childbearing.

Erosions of the cervix in those who have borne children are almost invariably the result of laceration of the cervix and will be considered under that heading.

MEDICATION. Pending the time when it is convenient for the patient to submit to the surgical measures described it will be found of advantage to apply to the cervix, nightly, the wool tampon charged with glycerine, medicated or plain, as preferred, and to exhibit suited remedies. Of these sepia stands first, though conium, graphites, silicia, platina and sulphur are also to be considered. If the engorgement is pronounced an application of glycerine with iodine is beneficial, and here anti-inflammatory remedies, as aconite, ferrum, belladonna and others, may be demanded. As a rule, however, there is but little if any need for medication in cervical erosion as the condition is purely surgical.

Calcarea, silicia, arsenicum, and other systemic remedies that improve the general health, may be employed to advantage in preparing the patient for operative procedures, and thus may act beneficially upon the local pathology. But as a rule efforts to relieve or improve the local condition through medication are futile.

CHAPTER XVIII.

ENDOMETRITIS, CERVICAL AND CORPOREAL.

Cervical Endometritis.—This is usually accompanied by pathological conditions of the extremity of the cervix. The mutual relations between the tip of the cervix and the lining of the cervical canal are matters of speculation that need not be considered in the present connection. As they are companions in their misery their recovery must be effected simultaneously.

Corporeal Endometritis.—This variety is accompanied by abnormal degrees of tension of the internal os, and dilatation should always be employed when the cavity of the uterus is entered for any purpose whatsoever.

Cervical endometritis may exist separately or at the same time with corporeal endometritis. The cervical canal may present an extravagant degree of chronic inflammation, to the extent of elongating the cervix or thickening it, and be pouring out quantities of thick, tenacious mucus while the body of the organ remains in a comparatively normal condition. On the other hand the endometrium may be thickly covered with exuberant granulations, and even filled with muco-purulent accumulations which the appearance of the cervix would never suggest, or the lining of both the cervix and body of the uterus may be more or less seriously involved in inflammatory processes at the same time.

Treatment.—**DILATATION.** The first step to be taken in performing any toilet of the endometrium is dilatation. This is best accomplished



Fig. 768.
Pratt's Uterine Sound.

by means of the successive introduction of graded sounds. The double sounds. (Fig.

768), are less cumbersome and more convenient than single ones, and are, therefore, to be preferred. Dilatation can proceed as rapidly as the instruments can be inserted and removed until resistance is encountered at the internal os. From this point until a satisfactory degree of dilatation is secured the operator should proceed with great caution. If the resistance is firm and unyielding some force may be employed, but it should be applied intermittently, steady pressure upon the sounds being avoided. The proper degree of dilatation will vary with different cases, from a No. 17 to a No. 27½, English scale.

It must be borne in mind when passing the smaller sized uterine sounds that the cervix and body of the uterus are two distinct structures, both in their nerve supply and in the arrangement of their muscular fibres. The internal os is formed from circular fibres of the lower part of the body of the uterus. Many times the cervix is soft and flabby, and in attempting to pass sounds into the uterine cavity the point of a sound will

pass into a sulcus by the side of the internal os and refuse to enter the cavity of the uterus, giving the operator the impression that the internal os is entirely closed. This sulcus sometimes completely surrounds the internal os, the opening to the uterine cavity being found in the centre of a cone-shaped projection which protrudes into the cervical canal. In other cases the sulcus is not complete and the internal os will be located at one side of the extremity of the canal. In such cases difficulty will be experienced in passing the smaller sounds, but the larger ones will more easily find their way. Force should never be used in entering a sound unless the operator is perfectly positive that its extremity is engaged in the internal os. In most cases it need be carried no farther than No. 18½ or 20. Valvular instruments for dilating the uterus are employed by many, but in the opinion of the author they should be avoided. They bruise and tear the uterine tissue unnecessarily. The fact is not commonly known, but it is nevertheless a fact that the uterus is almost invariably more or less lacerated when dilatation is carried as high as a No. 18½ English scale, even when it is accomplished by means of the graded sounds, which is the least violent and harmful form of accomplishing uterine dilatation. In most cases the laceration appears to be harmless, but occasionally it acts as a source of infection, and subsequent inflammation and its customary conditions are results. That the uterus is lacerated at the internal os in the practice of dilatation regardless of the care with which it is accomplished is demonstrated in cases where dilatation has been practiced in connection with hysterectomy. An examination of the uterine cavity in all such cases will demonstrate a well-defined laceration of the uterine tissue at the internal os. The laceration varies in length from half an inch to an inch, and in depth from a mere checking of the surface to a complete laceration into the areolar tissue. This is so uniformly the case that it is logical to infer that any considerable degree of dilatation of the uterine cavity which is accomplished at a single sitting is almost invariably accompanied by some degree of laceration. The laceration occurs laterally, on one or both sides. In view of this fact too great care cannot be exercised in practicing uterine dilatation. As it is impossible to enter the uterine cavity, however, without it, dilatation is not to be abandoned, but simply to be accomplished as gently as possible. Where there is much thickening of tissue at the internal os, regardless of the presence or absence of laceration of the cervix from childbirth, it is well to slit the cervix laterally its entire length so as to bring into view the internal os.

Frequently the endometrium at this point will present a large accumulation of fibrinous granulations, which should be removed by the aid of plug forceps and scissors. An exploratory incision of the cervix is neither dangerous or harmful, and should always be practiced when there is roughened and thickened tissue at the upper extremity of the cervical canal. The wound is readily closed by sheep-gut sutures, and as it always heals by first intention is never a source of either danger or harm. In dilating the uterus the degree of force that can safely be employed in the passing of sounds will depend upon the tonicity of the uterine tissue. If it is tough and fibrinous considerable force will be demanded. If the tissues are soft and succulent, however, the employment of force to any considerable degree is entirely uncalled for and is sure to produce exten-

sive and unnecessary laceration. The character of the uterus is to be determined by the degree of resistance which its tissues offer to the entrance of the tenaculum. An operator, by the aid of this instrument, can easily determine whether the uterine tissue be hard or soft or tough or friable, and gauge his manipulations of the sounds accordingly. A good rule to go by is to dilate until no more resistance is felt at the internal os than is offered the instrument throughout the length of the uterine cavity.

CURETTAGE. As soon as dilatation has been accomplished the uterine curette should be employed to scrape in a careful manner the whole surface of the endometrium. The Holbrook curette (Fig. 769) is well adapted for this purpose, as the instrument is well-balanced, and, being a douche as well, washes out all uterine debris as fast as it is loosened.



Fig. 769. Holbrook's Douche-Curette.

When granulations are present they will be found most abundant just above the internal os and in the uterine cornua at the orifices of the Fallopian tubes. In many cases, however, the entire endometrium is completely grown over with these unwholesome vegetations. It is not at all uncommon to secure at a single sitting a sufficient quantity of them to fill a tea- or dessert-spoon. Where they are very exuberant they cannot be removed at one operation, being prone to recur, and two or three curettings at intervals of a few weeks or months are required for their extermination.

In handling the curette, as in the employment of the sounds, the character of the uterine tissue is to be taken into consideration. A puncture through the uterus into the peritoneal cavity in cases where the uterus is either atrophied or softened is not so uncommon an accident as it should be. Although it may not result in a loss of life it will prevent the completion of the necessary work and be by no means a desirable complication of the operative procedure. In case the accident has occurred further interference with the endometrium is to be immediately abandoned except the drying of the uterine cavity, which is to be accomplished by gently introducing a small quantity of packing into the lower part of the uterine cavity and withdrawing it.



Fig. 770.
Bozeman's
Dressing-Forcep.

PACKING. After the uterus has been dilated and curetted it should then be packed. Many operators prefer for this purpose a narrow strip of iodoform-gauze. Antiseptically prepared candle-wicking is very satisfactory, however, and much easier of manipulation. Although there are several methods of introducing the packing, the uterine dressing-forceps (Fig. 770) are sufficiently satisfactory to render it unnecessary to refer to other means of accomplishing the same purpose. The candle-wicking is to be doubled and seized at its bend by the forceps, by means of which it is pushed into the uterine cavity as far as the

fundus, when the grip of the forcep is to be loosened and the wicking seized lower down and again carried upward, this process being continued until the cavity is full. It is better not to withdraw the forcep entirely from the uterine cavity until the process is complete, as the work can be more evenly accomplished without its removal. As soon as the uterus is well packed the packing is to be immediately removed and the uterus packed again, the object of the first packing being to dry the uterine cavity. While the second packing is desired in order to prolong the dilatation to whatever extent is deemed necessary no rule can be laid down to govern the length of time that a packing is to be left in the uterine cavity. A silk string should be fastened to the lower extremity of the packing and its free extremity is to be tied to a strip of iodoform-gauze, which is to be packed in the vagina about the cervix, and to the lower end of which another piece of thread of sufficient length to protrude an inch or two beyond the vulva is to be fastened. This arrangement is desirable to facilitate the removal of both the vaginal and uterine packing.

Packing may be left within the uterus from a few hours to several days, according to the reactive powers of the patient. If the uterus be irritable and the presence of the packing speedily inaugurates severe local pain and general disturbance of the system it had better be removed at once and the vagina thoroughly douched with hot water. But if the tissues are enervated, indolent, and sluggish, the packing may be retained to advantage for several days. In extreme cases of uterine inactivity, in addition to permitting the packing to remain for several days it is always well to renew it when removed for purposes of cleanliness. Such

prolonged dilatation is better accomplished by the aid of intra-uterine stems. These latter are extremely serviceable in the treatment of endometritis, and in most cases can be worn with impunity for several weeks if necessary.

STEM-PESSARIES. There are various forms of intra-uterine stem pessaries, of which three are especially worthy of mention. Hollow stem pessaries would seem desirable from a theoretical standpoint, but practically have nothing to commend them. The opening or openings, as the case may be, are quickly filled by mucus or granulations, and the central canal is so speedily obstructed as to be of no service whatever except to admit and retain a quantity of mucus or purulent discharges which should have an avenue of escape. All the exudations from the endometrium readily find exit by the side of the solid intra-uterine stem, and as the solid stem instruments are, therefore, much more cleanly than the hollow varieties they are to be preferred.

Where irritability is to be allayed and a tendency to stenosis is to be overcome stem No. 1 (Fig. 771) is to be preferred. In most cases it can be introduced at the orifice after passing



Fig. 771.
Intra-Uterine Stems.

a No. 7 or 8 uterine sound, and the patient will feel no inconvenience from its presence. If the internal os, however, shows a tendency to be patulous and does not possess sufficient grip to retain No. 1 in position No. 2 (Fig. 771) will be found serviceable. Although a solid stem it is olive-tipped and split longitudinally and moulded so that the two halves of its bulbous extremity have a tendency to spring apart. It is furnished by the shops in two lengths, so that it can be adapted to cases which possess either long or short cervixes. The bulb of course should pass beyond the internal os. Stem No. 3 (Fig. 771) is better adapted to patients who are to be kept in the recumbent position. As it has a large calibre it has a tendency to incite uterine contraction, which frequently causes its expulsion, especially if the patient is on her feet.

INTRA-UTERINE DOUCHE. The practice of intra-uterine douching is not to be encouraged except at times when sufficiently generous dilatation is practiced to permit the drying of the cavity by the introduction of packing.

CONCLUSION. All cases of endometritis are to be individualized and the treatment carefully adapted to the reactive powers of the patient. Many times a single treatment under an anesthetic is sufficient to effect a restoration of health. In most cases subsequent interference, either with or without an anesthetic, at longer or shorter intervals, according to the reactive powers of the patient, will be required before satisfactory results can be obtained.

Cases of acute endometritis, even when they have passed on to metritis, and beyond this to pelvic cellulitis, can be spared much suffering, time and danger by the prompt and thorough application of the methods just detailed. For chronic cases these methods are well-nigh indispensable.

Cauterization of the endometrium, either by the actual cautery or by caustics, has nothing to commend it and is productive of much and serious harm. Stimulating applications, where due respect is had to the surgical principle of free vent, are frequently serviceable.

Remedies that will be found of special value in endometritis are sulphur, kali bichromicum, sepia, platinum, calcarea carbonica, conium and thuja. It is not necessary to here recite their individual symptomatology. Combined with proper surgical measures they are frequently very helpful, while it will be extremely disappointing to attempt to cure the pathological conditions by remedies alone. The general health of the patient should, in every instance, be conserved as far as possible by a combination of proper hygiene, diet and medication, but nature should not be denied, in connection with all this, the relief obtaining from surgical treatment intelligently directed.

CHAPTER XIX.

LACERATIONS OF THE CERVIX.

General Considerations.—Women have suffered laceration of the cervix from time immemorial. In the older works upon gynecology the uterus is described as having two lips, probably because at that time only married women who had borne children were subjected to local examinations. The merest tyro in medicine to-day knows that the normal cervix has no lips, is well-rounded in form, and presents in its centre a circular opening of the external os.

As a large percentage of the cases of uterine carcinoma have their incipency in unrepaired lacerations of the cervix, and as sub-involution, chronic endometritis, both cervical and corporeal, retroflexion, prolapsus, procidentia, irritable bladder, and constipation, not to mention various forms of functional derangement of near and remote bodily organs and reflex disturbances, may all have their origin in cervical lacerations, they should never be permitted to go unrepaired for any considerable length of time.

Varieties.—There are many varieties of laceration of the cervix, and many methods of repairing them. It will be adequate if the three principal varieties of laceration of the cervix be considered here and a method presented adequate to the repair of not only these but to all possible conditions of laceration.

First: Bilateral lacerations of the cervix, in which no union has taken place and the wounded surface has cicatrized is by far the simplest form of laceration for the operator to encounter and the least harmful for the patient to possess. Because it is the one most readily recognized it is the least liable to be neglected. It therefore needs but very brief consideration.

The margins of the wounds are to be denuded of their cicatricial coverings and then brought into coaptation by sutures. Guys are placed in the centre of the extremity of either lip and passed to the hands of an assistant, who employs gentle traction upon them so as to prolapse the organ as far as it has a tendency to come without unduly straining its attachments. The guys are to be held in diverging directions so as to expose the full extent of the cervical canal. With scalpel or scissors the cervix is to be nicked at its lower extremity in four places, one on each side of either guy. These cuts should be deep enough to completely sever the mucous membrane, and should be made perpendicular to the surface severed, the direction of all the cuts being toward the position to be occupied by the external os when the operation is complete. The space between the two cuts on either lip should be a quarter of an inch in length. It prescribes the width desired for the external os. If it is too large, so as to induce ectropion, cervical catarrh, and other forms of cervical pathology, the trouble demands a secondary operation. With tenaculum or plug forcep and scissors or scalpel the cicatricial coverings

of the torn surfaces are next to be removed, always beginning the dissection at the end of the cervix where the first cuts were made. The denudation should be as wide as the cervical substance, extending from the vaginal covering of the cervix on the outside to its cervical lining on the inner. At the margins of the original tear care must be exercised that the line of denudation be very straight, and it should be made with scalpel or scissors before the cicatricial tissue is dissected away from the central part of the wound. It is a good plan to dissect the tissue away from both lips before it is removed from the bottom of the tear so that the denuded portion can be taken away as one continuous piece on either side. If the rent extends the full length of the cervix a branch of the uterine artery is sometimes wounded in removing the covering from its upper extremity. This may require the application of an artery forcep which may be left gripping the blood vessel until the operator is ready to close the wound. No ligature will be required. As the manner of closing the wound is similar in the three conditions to be considered it will be described later on.

SECOND: Bilateral laceration of the cervix, in which the wounds have entirely or partially healed. To Emmett, of New York, is due the credit for first demonstrating to the profession the fact that cicatricial plugs resulting from the healing of cervical lacerations were a frequent source of such local and general disturbance as to necessitate their removal by dissection. The fact is now established beyond controversy that cicatricial plugs are frequently mischievous, favoring the development of all forms of cervical pathology on the one hand and on the other a great variety of general complaints.

Lacerations of the cervix are ragged wounds, and in many cases are sufficiently deep and rightly placed for exposing nerve filaments, these becoming entangled in the plastic material which subsequently solidifies into cicatricial tissue. The gradual contraction of this tissue involves nerve impingement, to which is due the disastrous consequences of the tear. The relief, either local or general, or both, which is experienced by the patient upon the removal of cicatricial plugs is accounted for upon the theory that when the plug is dissected away all nerve filaments entering it are severed on a level with the wounded surface and consequently do not become re-entangled in the new scar by which the surgeon's wound is repaired. Whether this explanation be accepted or not is immaterial. The fact can no longer be disputed that in a large number of cases the cicatricial plugs which nature has formed in healing a lacerated cervix are prolific of ill health, local and general, and that their removal is in such cases invariably beneficial and consequently demanded. The benefits accruing from the operation are solely dependent upon the thoroughness with which the removal of the plugs is accomplished. Subsequent healing of the wound is not so important as the removal of every trace of cicatricial tissue, and cicatricial plugs which are prolific of pathology are invariably deep-seated. A method by which they can be safely and thoroughly dissected away without the destruction of normal uterine tissue, and without completely denuding the cervical canal at the internal os is invaluable.

THIRD: The third class of cases to be considered consists of those in which the laceration has been confined to the internal os and the cervix

has remained intact. The existence of plugs at the internal os can be suspected only by a process of exclusion, the patient manifesting symptoms of uterine disorder which can be explained upon no other hypothesis. Demonstration of their existence can be made only by the exploratory incision. Guys, above and below, are to be employed, and the cervix is to be severed on either side by a pair of straight scissors as far as the internal os. If cicatricial plugs are present their tissue can be readily discriminated from that of the uterus surrounding them and they are to be removed by dissection. Lateral exploratory incisions are to be selected, because in a large percentage of the cases the lacerations occur laterally.

Lacerations of the internal os, like those of the cervix, may fail to unite, leaving the internal os abnormally patulous. Sufficient tissue should always be denuded in such cases to reduce the calibre of the internal os to a normal size. It had better be left stenosed than too large, as undue contraction can be very easily overcome by subsequent use of the graded sounds without an anesthetic.

Where retroflexion accompanies laceration of the cervix the removal of the cicatricial plugs and the repair of the cervical wound in most cases restores the uterus to its normal vigor and the retroflexion disappears spontaneously. In debilitated subjects, however, an operation for the correction of the retroflexion will be demanded. Alexander's operation can be performed in suitable cases at the same sitting at which the cervix is repaired, the cervix receiving attention first. But the same rule must be observed here as in amputation of the cervix, that where ventral fixation is to be performed it should not be done at the same time that repair of the cervix is undertaken. In such cases it should follow the cervical repair so as to first give the uterus the opportunity of righting itself without assistance.

Types.—Ruptures of the cervix may take place unilaterally, bilaterally, or in several places. Deep lacerations are always single or double. Any form of laceration of the cervix may heal spontaneously or fail entirely of union, or heal partially. Where the cervix is torn in three or more places, constituting what is known as stellate lacerations, but one or two of the lacerations will be deep, the others being confined to the extremity of the cervix. Where the extremity of the cervix, in cases of laceration, has undergone cystic degeneration or an extreme condition of hypertrophy, accompanied by ectropion and erosion of the cervical mucous membrane, amputation of the cervix may be combined with the operation for laceration. Deep lacerations are usually located laterally. They are sometimes located posteriorly. Rarely do they occupy an anterior position.

Removal of Cervical Plugs.—Cervical plugs are to be located if possible by palpation. This can best be done immediately preceding or following menstruation, as the scar tissue at such times is congested, and being harder than the cervical tissue in which it is imbedded it can be definitely located. A small, deep-seated cyst may be mistaken for a cicatricial plug, but as slits in the cervix are never detrimental if they are subsequently closed a mistake of this nature would not be serious.

Where the laceration is only partially healed less difficulty will be experienced, as one at least of the cicatricial plugs is always at the bottom

of the ununited part of the tear. It is only in cases where perfect union has taken place that the operator is compelled to rely solely upon an exploratory incision for diagnostic purposes. Cases so obscure as to leave the operator in doubt as to the location of cicatricial plugs are, however, exceptional ones.

OPERATION. With an assistant steadying the guys the cervix is to be split along its entire length from side to side, an effort being made to sever the lower part of the scars in making the cuts. If the effort has been successful the cicatricial plugs can then be felt on either side at the bottom of the wounds in close proximity to the cervical canal, sometimes extending through the full thickness of the cervix. A tenaculum is now to be passed into the cervical canal and imbedded in the cicatricial tissue of one side at the bottom of the cut. A long, narrow-bladed, sharp-pointed bistoury (Fig. 772) is to be passed carefully into the cervical



Fig. 772. Sharp-Pointed Bistoury.

canal, its edge turned toward the scar and, the thickness of the plug to be removed being borne in mind, is made to sever the cervical tissue at its junction with the scar formation. This is to be done both above and below. The lower extremity of the cicatricial tissue will then be isolated from the cervix, having been split in two by the exploratory incision, and is to be seized firmly in the grip of a pair of plug forceps (Fig. 773). While an assistant is still holding the wounded surfaces apart the operator, with a pair of sharp-pointed scissors curved at their tip, is to continue the dissection of the cicatricial plug by carefully clipping it away from the surrounding cervical and corporeal tissues; for these deep lacerations involve the internal os and the plug sometimes extends beyond it and well up into the body of the uterus. The uterine tissue is softer than the cicatricial,

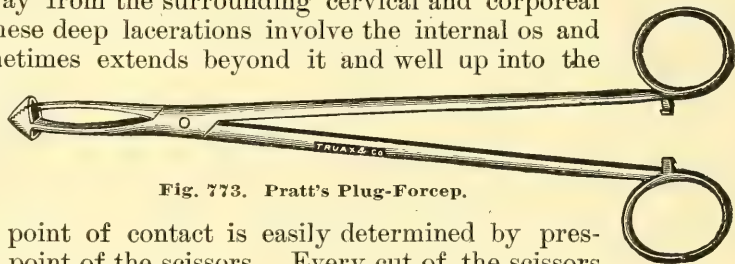


Fig. 773. Pratt's Plug-Forcep.

and the point of contact is easily determined by pressure with the point of the scissors. Every cut of the scissors should be preceded by a careful examination to determine this point. It is better to leave a thin covering of cicatricial tissue in the wound, thus tunnelling the scar, than to sacrifice normal tissue. The veneering can afterwards be removed by the aid of tenaculum and scalpel or scissors with less danger of wounding the uterine artery and inducing a stenosis at the internal os by cutting away tissue which should have been left unmolested. The index finger of the operator can readily determine when the scar tissue has all been removed. The corresponding plug on the opposite side is to be treated in a similar manner.

The external os and the lower part of the cervix are then to be shaped by the operator. For this purpose a tenaculum is to be imbedded in one edge of the exploratory incision, and a long, narrow-bladed, straight scalpel is to be inserted in the cervical canal, with its edge directed toward the cervical flap receiving attention. By its aid the cervical mucous membrane is to be cut in a straight line, whose upper extremity marks the outer limit of the external os to result from the

operation. The triangular fragment of tissue thus marked out is now to be taken away with scalpel or scissors, care being taken to sever the vaginal covering of the vaginal flap in a straight line, which extends from the point of the cervix to the bottom of the exploratory incision at its vaginal extremity. The same procedure is to be accomplished on the other side of the same flap, and also on both sides of the opposite flap. This will leave a straight track of unmolested mucous membrane in the centre of both cervical flaps which, when the wounds are closed, will constitute the new cervical canal. Obliteration of the internal or external os or cervical canal in this manner is rendered an impossibility.

Where the union of the original tear has been incomplete and hyperplasia of the cervical membrane has resulted, producing a club-shaped and pouting appearance at the cervix and having an eroded appearance, it is desirable to remove as much of the hypertrophied tissue as possible. In such cases the unmolested central strip of mucous membrane presents prominent ridges, and if the wounds are closed without trimming down these ridges they will choke the canal and strain the stitches placed at the extremity of the cervix, frequently causing them to cut through the tissues, and they will also press the lower extremity of the wound so wide apart as to induce non-union. This can be avoided by removing a thin slice from one or both of the prominent ridges. If the trimming is confined to the epithelial layer of the mucous membrane covering the surfaces they will be in no danger of uniting, and obliteration of the lower part of the canal will not occur. If one ridge is especially prominent it may be entirely removed, providing the other one be permitted to remain undisturbed. The pressure upon the ridges caused by the approximation of the two sides of the cervix will soon produce absorption and the hyperplastic condition will speedily and permanently disappear.

Sutures of the Cervix.—Sheep-gut, kangaroo-tendon, silk-worm, or No. 27 silver wire may be employed, or silver wire may be used on either side of the extremity of the cervix and sutures of other material may serve to close the remaining part of the wound. Wire is not used as much as in the past and sheep-gut is gaining in favor. If silver wire be employed it should be removed on the eighth day. On the following day the patient can sit up unless menstruation supervenes, in which case the recumbent position should be maintained until the function is performed. In inserting stitches those at the end of the cervix should be introduced first. All stitches should be introduced a quarter of an inch from the margin of the wound, and should never pierce the track of cervical mucous membrane. If the vaginal margins of the wound are nicely coapted there will be no tendency to displacement of the cervical borders, and when the stitches are made to penetrate the cervical track which has been left unmolested they choke the cervical tissue unnecessarily, obstruct its nutrition, and interfere with the healing of the wounds. If silver wire be employed for the sutures it should be placed no tighter than is necessary to gently bring the raw surfaces in contact. By the aid of a pair of tenacula inserted under the stitch it is to be bent at right angles at the point where it pierces the vaginal mucous membrane. The twist should be half an inch in length, and its extremity should be curled. The curl at the end of the stitch not only prevents pricking of the vaginal walls but

facilitates removal. It is a simple matter to remove silver sutures. A tenaculum can seize the curled extremity and when traction brings the single wire into view it can be clipped on one side and then pulled away from its position. The stitches at the end of the cervix should be the last to be removed, and after the wire has been severed the expansion of the speculum should be lessened so as to remove the tension from the wound before the stitches are pulled away.

The stitches may be removed through a bivalve speculum, but a short, broad-bladed Sims' speculum, with retractor, is best adapted for operative purposes. The uterus should not be forced into a prolapsed condition, but it may be made to descend as low as it will come without violence.

After-Treatment.—The preparation of the patient for laceration of the cervix is the same as that required for other forms of uterine work. Vaginal douching will not be called for during the first week or ten days after the operation for laceration of the cervix. But when the operation is completed the vagina should be thoroughly douched, dried, and a strip of iodoform-gauze inserted against the extremity of the cervix, to be left in position for forty-eight hours. Where union by first intention is not secured and suppuration supervenes the vaginal douche is to be employed. It may be medicated according to the judgment of the operator. A weak carbolized solution is needed where the discharge is offensive, while a douche medicated with hamamelis is perhaps preferable in cases manifesting a tendency to congestion or inflammation. The operation is not a dangerous one. If really necessary it may be undertaken immediately preceding menstruation, as the appearance of menstruation does not appear to interfere with the healing of the wound. The most favorable time for operation, however, is a week or ten days after menstruation has ceased.

NAUSEA. The occurrence of nausea and vomiting after the operation does not interfere with the healing of the wound. During the operation it is very apt to be induced by the dissecting away of the plugs, frequently illustrating the intimate association existing between the cervical tissues and the stomach. When nausea occurs while the patient is under an anesthetic it is well not to interfere with the evacuation of the stomach. When the stomach is empty, however, and the patient is merely retching, it had better be stopped by dilating the anus with a rectal bivalve, this reversing the peristalsis.

HEMORRHAGE. In many cases the operation for laceration of the cervix will be almost bloodless regardless of the extent of the dissection. Other cases show a disposition to bleed under the slightest provocation. A prick of the double vulsellum or tenaculum, every cut of the scissors or knife, even the introduction of the sutures, is attended by a loss of blood. The operation can be satisfactorily performed in such cases only under the play of a steady stream of hot water. As a rule the operation is not a bloody one, unless the operator carelessly carries his dissection entirely through the cervical tissue, in which locality he is very liable to wound the uterine artery. Should this accident occur the hemorrhage will be so excessive as to immediately fill the vagina with blood and bewilder a timid operator. The speculum and retractor are then to be immediately removed from the vagina and the index finger of the left hand of the operator is to be inserted in the bottom of the cervical wound and made

to press firmly upon the wounded artery. An artery forcep can then be passed by the side of the finger and the full thickness of the cervical tissue at the bottom of the wound can be pinched in its grasp. As soon as the artery has been secured in this manner the speculum and retractor may again be introduced, the blood washed from the vagina, and the artery tied sub-mucously by the aid of a short curved needle threaded with silk.

The location of the uterine artery on either side corresponds to the extremities of a straight line passed from side to side through the centre of the circle formed by the vault of the vagina. Its throb can usually be felt through the vaginal wall, as it lies very near the mucous membrane. As soon as a ligature has been passed around the uterine artery the artery forcep can be removed and the operation completed.

The so-called circular artery is a myth. It is true that the uterine arteries as they approach the cervix at its upper extremity give off anastomotic branches, both in front and behind the cervix, by means of which the two uterine arteries communicate. But the branches are slender, their location is irregular, and the cervix can be split in a perpendicular direction and the wound carried throughout its entire length and well up into the body of the uterus, severing also the surrounding layers of areolar tissue, without excessive hemorrhage. If it be remembered that the uterine artery ramifies in the areolar tissue at the side of the cervix and can never be wounded so long as dissection is confined to the uterine tissues it will at once be seen that with the exercise of a reasonable degree of care the wounding of this artery should never occur in the operation for laceration of the cervix. The cervical tissue, especially just below the internal os, is sometimes exceedingly thin and is readily penetrated. But if the dissection is always made in close proximity to the scar the thickness of the cervical wall need never be taken into consideration. Occasionally where the cervical tissue has been punctured but the wound has not been carried far enough into the areolar tissue to wound the uterine artery this vessel can be seen bulging into the bottom of the wound. It has the appearance both in size and color of a medium sized angle worm. It has sometimes been mistaken for a fragment of cicatricial tissue, where the operator has been guided by his sight rather than his sense of touch, and it has been carelessly severed. All hemorrhage soon ceases after the wounds are closed.

CHAPTER XX.

VAGINAL HYSTERECTOMY.

Applicability.—Hysterectomy is only justifiable when destructive processes have invaded uterine, ovarian and tubal tissues to such an extent as to be beyond repair by other processes, and become a perpetual menace to the life and comfort of the entire body. Not all cases of fibroid tumor demand uterine extirpation. If they are intra-uterine they can be removed after the manner just described. If they are intramural they can many times be dissected out and the organ saved. If they are sub-peritoneal they can be taken away from the uterus through vaginal or abdominal section without injuring the organ.

Indications for Hysterectomy.—The conditions demanding hysterectomy are: First, fibroid tumors too complicated and extensive to permit of removal by less heroic measures, especially when manifesting a tendency to undergo degenerative changes either of a benign or malignant type; second, procidentia in women who are past the menopause, accompanied, as it always is, by cystocele and rectocele, is best treated by hysterectomy, and has already been sufficiently referred to in its proper place; third, chronic pelvic cellulitis; fourth, in cases where the removal of the tubes and ovaries is demanded the uterus should also be removed; fifth, carcinomatous degeneration of any portion of the uterus, even in its incipency, demands the immediate removal of the organ as soon as a correct diagnosis has established the fact of its existence; sixth, in the opinion of the author conditions of atrophy of the uterus, ovaries and tubes—in which hysterectomy is not only valuable but indispensable to the preservation of life.

Although the removal of the uterus and its appendages is an extreme measure and should never on any account be undertaken without sufficient cause, nevertheless it is by no means so formidable or serious an undertaking, either in its performance or in its final results, as has been heretofore considered. It is a last resort, yet at the same time in most cases a very effective one. There is always a marked degree of relief, comfort and bodily health attendant upon the removal of an organ whose identity has already been destroyed by morbid processes. No grave apprehensions need be entertained, therefore, as to the physical or psychological effects of a hysterectomy properly executed whenever the operation is demanded. The sacrifice of a part when necessary to the preservation of the whole is a principle of universal application, being operative in the human body as well as out of it. Under this law the uterus and its appendages are often righteously doomed to destruction.

Hysterectomy for Fibroidata.—When the operation is undertaken for the removal of fibroid growths which are inimical to the general health of the patient, and intractable to any other form of operation or treatment, the patient is to be anesthetized, the parts properly prepared, and the patient placed in the lithotomy position, either limb

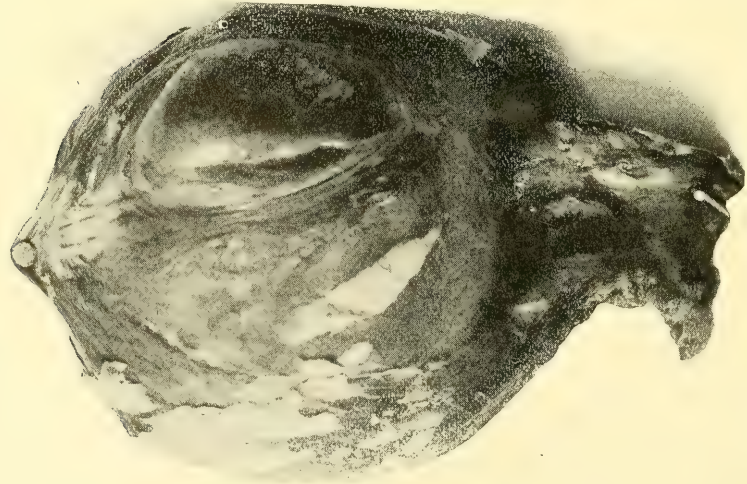


Figure 1.
Uterine Fibroma, $3\frac{3}{4}$ lbs.
Vaginal Hyster-
ectomy. . . No ligatures or clamps employed.
Recovery.



Figure 2.
Uterus and one Ovary (greatly en-
larged) and Tube removed in contin-
uity. . . Carcinomatous degeneration of
endometrium. Other Ovary removed
two years previously by Celiotomy.
Recovery.



Figure 3.
Uterine Fibroid $2\frac{3}{4}$ lbs. removed without clamps or lig-
atures by vaginal route. . . Tubes and one ovary dissected
away without severing uterine attachment. Other Ovary
buried in adhesions, destroyed in removing. Recovery.

being flexed and held by an assistant. The cervix is then exposed by the aid of a Sims' speculum and retractor, seized upon one side by a double vulsellum and secured by a guy. The other side is to be similarly treated. The toilet of the uterine cavity is then to be performed by the aid of dilatation, curetting and packing. If the mass to be removed is sufficiently small to permit of its extirpation without division it may be dissected away without laying open the uterine cavity. If, however, the tumor or tumors must be taken away by piecemeal, first the cervix and then the body of the uterus should be split perpendicularly and everted by the aid of heavy tenacula. Through this opening intra-uterine growths can be removed and intramural ones can be enucleated. Sub-peritoneal developments will not be brought into view until the uterus is halved and dragged out through the vagina, one-half at a time. As fast as sub-peritoneal growths appear in the field they can be gripped by a double vulsellum or large uterine hook and removed, leaving room for the descent of one growth after another until the last one has been taken away. This process can be executed on both sides, after which it is an easy matter to remove the uterus, one-half at a time, dissecting away also the ovary and tube on either side by severing the peritoneal coats which enwrap them with a pair of blunt-pointed scissors, care being taken to make the wounds in the broad ligament in close proximity to the structures to be removed.

The entire operation is in many cases a bloodless one if the tubal, ovarian and uterine tissues be all closely hugged in the dissection. Where, owing to an unusually dilated condition of small blood vessels, or to carelessness in operating, excessive hemorrhage is encountered the bleeding vessels can be readily seized by an artery forcep and ligated. If the operator has been careless about keeping his operating field well in view and hemorrhage demanding attention occurs beyond his reach, the uterine artery should be tied after the manner described in discussing hemorrhage in connection with the operations for laceration of the cervix.

After the offending mass of tumors and the uterus, ovaries and tubes have been removed sutures are to be applied in three places. The tracks along the upper margin of the broad ligament on either side which have been wounded by the removal of the ovaries and tubes are to be secured by a continuous suture of No. 1 sheep-gut. These can be easily located and manipulated in most cases by the aid of retractors, tenacula and "T" forceps. It is not necessary to make a separate seam for the wound made in the removal of the Fallopian tube and the ligament of the ovary, as the wounds are narrow and parallel and they can be united by a single suture. Both sides are to be treated in this manner, after which the circumference of the wound in the peritoneum made by the removal of the uterus is to be secured by a running stitch of sheep-gut by means of which the entire opening is closed, the tightening and tying of the thread acting as a puckering string. Should the intestine or omentum at any point in the operation protrude themselves into the field of operation so as to obstruct the view of the operator and invite injury they are to be excluded from the operating field by the insertion through the wound of a large gauze sponge prepared for the purpose. A string should be fastened to the sponge to facilitate its removal, which should be accomplished just before the opening of the peritoneum is closed by its puckering string.

Tumors to the size of five pounds can be taken away in this manner with less shock and with less danger of sepsis, consequently with less danger to the patient, than is offered in their removal by abdominal section.

Where a narrowed vagina affords insufficient room for operative procedure it can easily be enlarged by a longitudinal incision directed posteriorly.

After-Treatment.—After the hysterectomy has been performed the wound should be closed by a continuous suture of sheep-gut. The wound in the vaginal vault should not be closed, but be packed with iodoform-gauze, which may be applied directly to the wounded surface or against a piece of antiseptically prepared China silk, the centre of which is carried into the bottom of the wound and its margins held apart while the silk bag thus formed is being packed with iodoform-gauze. The silk covering and iodoform-gauze are then to be pushed into the vagina and another strip of iodoform-gauze may be placed well up in the sulcus between the silk-wrapped plug and the surrounding vaginal wall.

Although the removal of large tumors by the vaginal route requires considerable manipulation the bruising occasioned by the handling of the parts is made upon the endometrium, which is afterward removed, so that the traumatism is not an objectionable feature.

Plates XXIV and XXV illustrate pathological specimens of fibroid development removed by vaginal hysterectomy.

Advantages.—The advantages and possibilities of the vaginal route for the extirpation of small sized fibroids are not yet sufficiently appreciated. Large ovarian tumors can also be removed by way of the vagina when they are cystic. Where repeated attacks of pelvic peritonitis have agglutinated the omentum and intestines to the outer surface of the uterus, ovaries and tubes, rendering removal of the organs by celiotomy extremely difficult or impossible, enucleation of the offending mass can be effected by way of the vagina.

When uterine fibroids have attained such growth that the entire mass will exceed in weight four or five pounds their removal is best accomplished by celiotomy. Brief mention will be made of this class of cases in order to illustrate a new method for their removal, by which the ligation of stumps is entirely dispensed with and the shock and danger to the patient is materially lessened.

The conditions of procidentia calling for hysterectomy and the method of operating have already been described.

Hysterectomy for Chronic Pelvic Cellulitis.—Chronic pelvic cellulitis nearly always means chronic salpingitis and pelvic peritonitis as well. The condition may be local or general. When the condition is local its favorite seat is posterior to the uterus, although it is by no means uncommon to encounter a localized cellulitis of long standing and well established in either broad ligament. Local cellulitis situated anteriorly is a very rare affection. When the condition is general and the uterus is firmly anchored at its centre it is usually fixed high in the vagina. The parts about the uterus are often honeycombed by fistulous tracks into which chronic cellulitis has finally terminated.

When dilatation, curettage and packing of the uterine cavity, together with enlarging and packing of the pus tracks, and the treatment



Figure 1. Uterine Fibroid.



Figure 2.
Figures 2, 3. Uterine Fibroid Segmented—Pratt.



Figure 4.

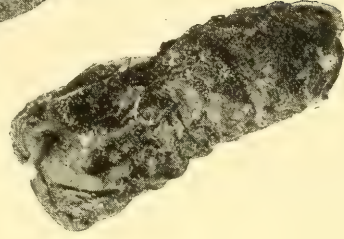


Figure 5. Atrophied Uterus.



Figure 6.

Figures 4 and 6. Uterus and Ovaries by Vaginal Hysterectomy.
Small Fibroid Tumors Below—Pratt.

by proper medication, local and general, have all failed to afford relief, and the patient is gradually succumbing to the enervating effects of a trouble which cannot be cured by milder measures, vaginal hysterectomy is not only possible but is also demanded and curative. When the swollen and inflamed condition of the cellular tissue has raised the level of the peritoneum beyond its accustomed height the broad ligaments are usually stiffened by inflammatory products, so that after the uterus is removed the ovaries and tubes will sometimes be found to be beyond the reach of the operator and removal cannot be accomplished through the vagina. In such cases they are to remain unmolested unless at a later period they become such evident sources of irritation that their removal is demanded, when they can be removed by the abdominal route. Where the uterus is anchored either backward or forward by adhesions resulting from inflammatory action unusual care must be exercised in its extirpation in order to avoid wounding the rectum or bladder.

When the uterus is held high and firmly in the grip of inflammatory products, so that it is difficult of access and well-nigh immovable in its position, hysterectomy is difficult of accomplishment. At the same time it is a possible operation, and unavoidable in extreme cases. Before undertaking the operation every effort should be made to reduce the chronic inflammation as much as possible by the aid of medicated tampons containing more or less glycerine, and by bimanual manipulation and douching. In most cases much of the congested area which the operator will invariably encounter at his first interview may be reduced until nothing retains the uterus in its fixed position but the false ligaments formed by inflammatory adhesions. Most cases of the inflammatory type can be successfully treated without hysterectomy, but the operation will be occasionally demanded.

Hysterectomy for Degeneration of Tubes and Ovaries.—Many surgeons will enter a protest against the advice to remove a fairly normal appearing uterus simply because it is deemed necessary to sacrifice the ovaries and tubes for extreme degenerative changes of these organs. The trend of surgical opinion, however, is at the present time turning in this direction. It is beginning to be recognized that ovarian and tubal affections are always secondary to uterine conditions, and to remove them and leave the uterus still intact is to take away the effects of a disease and leave its cause still operating to the detriment of the patient. Every uterus is not as innocent as it looks; and as the organ, even if in a normal condition is practically useless after the ovaries and tubes have been removed, and as, on the other hand, it is never in a normal condition in such cases but invariably presents sufficient pathological lesions to justify its taking away, and also as it is a more simple and proper surgical proceeding to remove uterus, tubes and ovaries by the vaginal route than the ovaries and tubes alone by either route, the uterus should always be sacrificed when tubal and ovarian disease of both sides demands the removal of these organs.

OPERATION. After a carefully prepared toilet of the pudenda, vagina and endometrium, the lower extremity of the cervix is to be seized by a double vulsellum or anterior and posterior guys, and while it is held well drawn down by an assistant the mucous membrane covering its surface is to amputated with sharp-pointed scissors close to the external os

in the anterior three-fourths of its circumference. Posteriorly the cut may be carried one or two inches up the vagina, thus leaving a "V" shaped piece of the vaginal mucous membrane adherent to the posterior surface of the cervix. The object of enlarging the opening at the back part of the vagina is to afford ample room through which to operate. This first cut should completely sever the vaginal covering of the cervix and the underlying areolar tissue, leaving the cervix intact. A sharp-pointed spud should now be employed to peel the tissues back around the entire circumference of the cervix as far as the internal os. At this point a dense membrane, formed by the deep areolar tissue in which the anterior and posterior uterine ligaments are blended, and which is the main factor in supporting the uterus in a normal position in health, will be encountered. This fibrous membrane is to be severed at its uterine attachment all around the organ. The spud which terminates the handle of the hysterectomy knife is now to be employed to penetrate the areolar tissue close to the body of the uterus, both in front and behind, until the reflections of the peritoneum are encountered.

By the aid of the hysterectomy knife or a pair of blunt pointed scissors, slightly curved at their tip, the uterus may be freed laterally to a corresponding height. The field of the operation is always rendered accessible by the gradual descent of the uterus, which occurs as its ligamentous and areolar supports are severed. While the assistant is dragging the uterus downward and forward the peritoneum at the back of the uterus, which forms the floor of Douglass' cul-de-sac, should be seized by a tenaculum and entered by the aid of a pair of scissors. As soon as the peritoneal cavity has thus been opened posteriorly it is to be enlarged laterally by the aid of scissors or hysterectomy knife until the wound is carried as far as the posterior surface of the broad ligament at its approximation to the uterus on either side. The cervix is now to be carried backward by the assistant and the peritoneal cavity is to be opened in front and the opening enlarged in a similar manner and to a corresponding extent as the one located posteriorly.

Where the ovaries and tubes, although badly diseased, are not fixed in their position by adhesions or inflammatory products they will be found sufficiently movable to permit the anteversion of the body of the uterus through the anterior opening in the peritoneum. This can be accomplished by the aid of two or three stout tenacula. The tenacula can be single or double (Figs. 776 and 777). By their aid the fundus of the uterus may be readily brought through the anterior opening in the peritoneum, the fundus protruding well into the vagina, when it is to be seized by a stout vulsellum (Fig. 774), and while the assistant employs traction to drag the organ well toward the posterior part of the vulva, the operator by the aid of his index finger, introduced into the peritoneal cavity in front of the uterus, feeling along the upper edge of either broad ligament, can accurately ascertain the location and condition of the tubes and ovaries. Their removal can be accomplished in one of two ways, as follows:

If the broad ligament is sufficiently lax to permit the distal extremity of the tube and the corresponding ovary to be well prolapsed into the operating field they can easily be dissected away from their attachment to the broad ligament from without inward by a pair of dull-pointed

scissors. The dissection should be made in close proximity to the tube and the broad ligament of the ovary and be carried as far as their attachments to the lateral border of the uterus, which are to be left unmolested. The wounded peritoneal tracks in the broad ligament which their removal has involved can be secured by a continuous suture, which should close both wounds at the same time, a single suture nicely coapting the outer margins of the two tracks and holding them snugly in coaptation. The remaining ovary and tube are to be removed and the wounds in the peritoneum closed by a continuous suture in the same manner. The uterus is now retained in its position solely by the attachment of the upper portion of the broad ligaments. These should be severed and the specimen, consisting of the uterus, with the ovaries and tubes still attached, is removed. The wound is to be closed in the manner described in hysterectomy for uterine fibroids.



Fig. 774.
Heavy French Vulsellum Forcep.



Fig. 775.
Small French Vulsellum Forcep.

It is not always, however, that the diseased ovaries and tubes are found sufficiently mobile for their removal to be accomplished in the manner described, or even to permit the anteversion of the uterus into the vagina, by the accomplishment of which the dissection of the uterus from its environing tissues can be completed from above downward. In such cases the entire operation must be performed by working from below upward, and the removal of the ovaries and tubes can be done only after all attachments to the uterus have been severed and the organs are removed. In this

class of cases the removal of the tubes and ovaries is to be accomplished from within outward, proceeding from the point where their uterine attachments were severed. The suture which is to coapt the wounded margins of the peritoneum along the tracks where the ovaries and tubes were removed should be started before the organs are completely detached, to facilitate the manipulation of the tissues.

Adhesions.—A large number of these cases are products of gonorrheal infection. Salpingitis and inflammatory products from localized peritonitis and cellulitis have furnished an abundance of adhesions, which must be broken up before the removal of the organs can be effected. This is to be accomplished by carefully tearing the parts from the surrounding tissues by the index finger. The fimbriated extremities of the fallopian tubes are no longer to be seen, but the outer end of the tubes are enlarged, club-shaped and agglutinated to the badly disorganized ovaries. The attachments of the Fallopian tubes to the ovaries are not to be broken up, as the disorganized masses which are thus encountered are frequently filled with pus and their removal should be effected without

evacuating their contents. When possible the peritoneal wounds made by their removal should be closed by the completion of the continuous suture already started. Where the peritoneal adhesions have been extensive,



Fig. 776. Author's Small Tenaculum.

however, this is not possible, and in such cases the lower openings of the peritoneum should not be entirely closed, but sufficient space left for the introduction of a strip of iodoform-gauze for purpose of drainage.

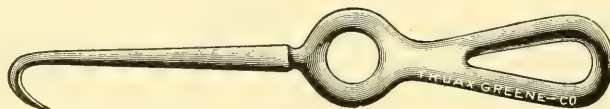


Fig. 777. Author's Heavy Fibroid Tenaculum.

Sometimes, indeed, owing to the unusual elevation of the peritoneum and the stiffness of the severed tissues it will be found impossible to close the wound in the peritoneum by a puckering string. The opening must be plugged with silk-wrapped iodoform-gauze for a few days until healing progresses far enough to prevent vaginal crowding of the omentum and intestines. Otherwise the case is to be completed in the manner described when considering hysterectomy for fibroid degeneration.

CHAPTER XXI.

HYSTERECTOMY FOR OTHER DISORDERS.

Carcinomata.—The value of the knife in the treatment of carcinoma is a question upon which there is a great diversity of opinion among medical men, but as the discussion of this question is not germane to the subject under consideration it will not be considered in the present connection. The success of thorough surgical interference in this class of cases bears a sufficiently favorable comparison with all other forms of treatment which the profession has to offer as to well deserve careful consideration of the best surgical methods to be employed in such cases.

Carcinoma of the uterus may invade the body of the organ, spreading from thence outward to the ovaries and tubes and downward into the cervix. In a very large percentage of cases, however, the cervix is first affected and the continuous and contiguous tissues later on. If the condition can be diagnosed and the patient secured for treatment while the disease is still confined to the cervical or corporeal tissues, or both, the extirpation of the uterus is to be accomplished as just described, except that in amputating the mucous membrane at the lower extremity of the cervix the cut should be made sufficiently high upon the cervix to insure the removal of all the infected tissue. If this involves so high an amputation of the vaginal mucous membrane in front as to require the denudation of a portion of the under surface of the bladder care must be taken in making the dissection not to penetrate that organ. To avoid this it may be necessary to fill the bladder and secure the contents by a stitch applied around the lower part of the urethra. This will cause the bladder to assume a hard, rounded outline, which will serve as a satisfactory guide in making the dissection. Otherwise the description of hysterectomy already given furnishes all the instruction necessary for the management of such cases.

Unfortunately for both surgeon and patient in too many cases of uterine carcinoma relief is not sought until the disease is well rooted and much destruction of tissue has already been accomplished. The uterus may be entirely disintegrated and nothing but a mere shell of tissue comprising the uterine outlines remain. In some cases the cervix may be entirely gone and much of the upper part of the vagina destroyed; or, at other times the pelvic tissues may be destroyed beyond recognition, and exploration by way of the vagina discloses a veritable chamber of horrors, in which no semblance of normal tissue can be recognized, and the bladder, rectum and intervening tissues, which have not yet been entirely consumed, are found matted together in one solid mass of infected infiltration.

MEDICATION. Of course there is no cure for such cases as these and a little temporary relief is the only result to be hoped for. All such cases do not suffer severe pain. There are cases, however, which suffer severely and in which even morphia seems to have no power to relieve.

Codeine, phenacetine, antikamnia, chloral and opium at best afford but partial relief, and what is found to best relieve the suffering patient, regardless of its unpleasant effects upon the general system, should be employed. The hope for cure is already gone and the remaining days of the patient should be made as endurable as possible.

DISINFECTANTS. Local measures will usually be required to subdue the horrible stench which characterizes all such cases. All debris that can be removed without inducing fatal hemorrhage should be curetted away, either with or without the employment of an anesthetic, and the vagina packed with iodoform-gauze saturated with Bovinine. A bichloride or carbolic solution may be used as a douche two or three times a day, this always being followed by the introduction of the packing direct from a cherry-colored solution of permanganate of potash. Bovinine, employed in full strength, either as an injection or upon gauze, seems to be efficacious in disinfecting the part and antidoting the poisonous nature of the discharge. If severe hemorrhage is encountered it is to be stopped by firmly packing the vagina or by deep stitching.

LOCAL DISSECTION. In cases where the cervix and more or less of the vault of the vagina have been destroyed, if the affected tissue is still movable and the rectum and bladder are free from invasion, the patient's life can be spared for a considerable length of time and a surprising degree of comfort and satisfaction be secured by dissecting away the infected area. In accomplishing this it is a great point to remove if possible all of the diseased tissue in one piece by a smooth dissection, leaving no fragment to go back, when the dissection is completed. The amputation of the mucous membrane is the first step in the operation. This should be accomplished at least half an inch from its infected margin, wherever that may be. In some cases this will involve merely the removal of the vault of the vagina, while in others a denudation of the entire surface of the bladder and the vaginal surface of the rectum as well will be required. Wherever the ulceration has spread it will be found everywhere walled in by an inflammatory zone thrown up by nature as a defense. This hardened, inflammatory tissue is placed like a basement membrane, upon which the ulceration is everywhere spread. It is to be the surgeon's guide in his dissection. After the vagina has been amputated around its circumference, always keeping fully half an inch below its invaded margin, the dissection is immediately to be carried deep enough to remove this thickened layer of tissue. The dissection should be made evenly upon all sides, all hemorrhage being controlled by artery forceps and ligatures as it is encountered. There should be no effort to hug closely the infiltrated tissue, but, on the contrary, it should be as far from it as is consistent with safety to the surrounding organs. After the dissection has passed the location of the internal os the subsequent part of the operation is to be completed as in hysterectomy for other conditions. The fundus of the uterus and the ovaries and tubes will usually be found to be in fairly normal condition. Care must be taken after the dissection has proceeded beyond the internal os to avoid wounding the ureters. This is not an accident so liable to occur as where the infection has proceeded so far as to involve the region of the ureters, and to endanger them when the dissection is made. This is one of the hopeless cases already described, and no attempt should be made to remove the

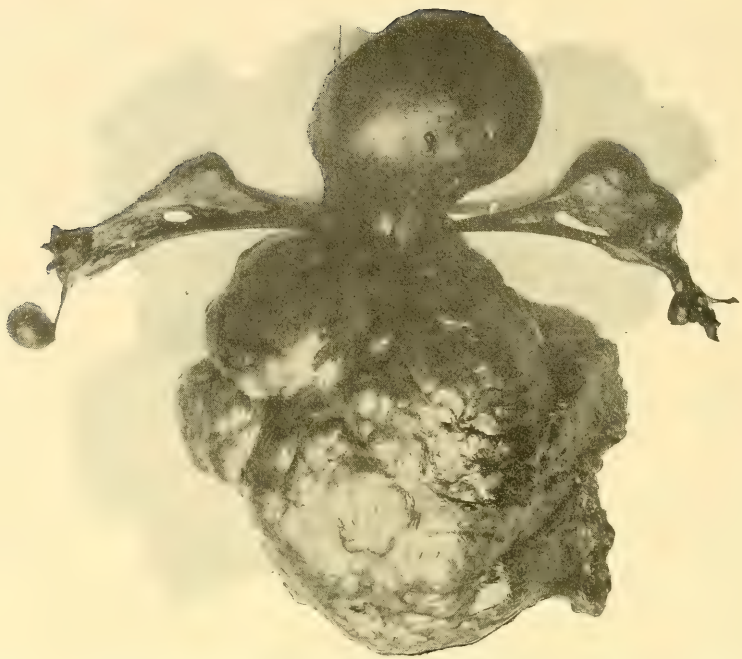


Figure 1. Vaginal Hysterectomy for Redundant Vagina and Uterine fibroid. Tissues named removed intact.—Recovery.—Pratt.

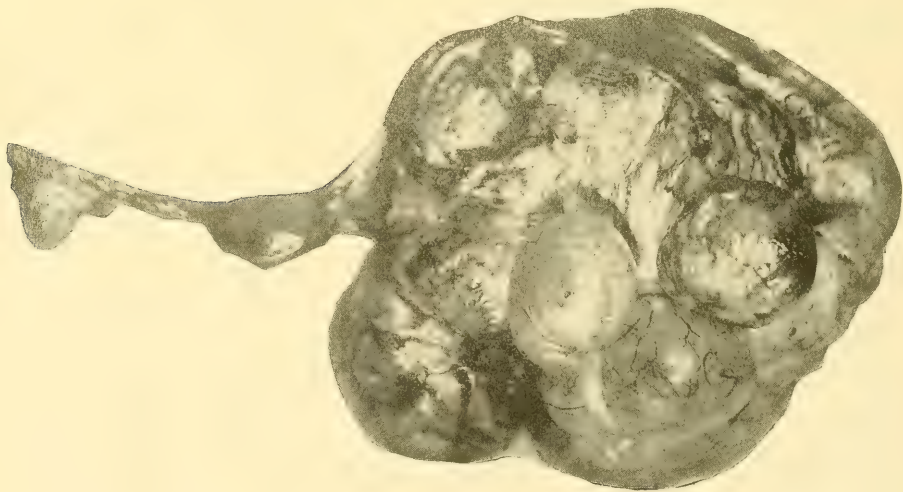


Figure 2. Fibro-Cystic Tumors of Ovaries Removal by Abdominal Hysterectomy without Ligation of Stump.—Recovery.—Pratt.

infected structures by dissection. The upper part of the wound is to be closed as in other hysterectomies and as much of the vaginal wound is to be covered by coapting the portion of it remaining unmolested as is consistent with free drainage and the circumstances of the case.

Cases which cannot be successfully operated upon by this method are too far advanced to be candidates for operative interference.

Hysterectomy for Pathological Atrophy of the Uterus.—

The importance of well developed sexual organs as a basis of general health is a subject that must sooner or later demand the serious consideration of the medical profession. An organ should never obtrude itself upon the attention of the body. A healthy organization is never conscious of head, heart, lungs, stomach, liver, or any other separate part of the organization.

The classes of pelvic disorders previously described in most cases manifest themselves to the consciousness of the patient, and for this reason the surgeon has been consulted.

Irritable and hypertrophied conditions of the organs of the body are self-assertive, but although more mischievous in their effects upon the general health, atony and atrophy of the pelvic organs are such painless and unobtrusive affections that patients afflicted with these subtle, deep-seated forms of pathology frequently escape examination. This is true of the rectum and it is equally true of both the male and female sexual organs. When the uterus, ovaries and tubes are thus affected the citadel of sympathetic vitality has been invaded and despoiled, and a restoration of the body to a normal state demands a re-establishment of sexual tonic-ity and strength which involves a re-establishment of a healthy condition in the organs under consideration. This can frequently be accomplished by dilatation, uterine packing, intra-uterine stems, electricity, and medication, local and general, but not always. Many times the disease has progressed so far and the vitality of the parts has been so thoroughly consumed that more radical measures will be required before satisfactory relief can be obtained.

The fact is established by experience that the removal of the uterus, ovaries and tubes in cases of extreme atrophy of those organs suspends the prodigal expenditure of sympathetic nerve-waste for which they were responsible, and permits a restoration to health in many cases in which other measures had failed to re-establish health. Ovaries which are free and movable in the pelvic cavity may become enlarged to a considerable extent with perfect impunity. But when their entire surface has been covered by cicatrices resulting from chronic inflammation from adjacent tissues the unremitting and steadily increasing pressure to which they are subjected, from the gradual contraction of the cicatricial tissues, squeezes the vitality out of them and taxes the sympathetic nerve-force to that extent that impingement of the ovaries is capable of accomplishing. When such ovaries are encountered they are more or less difficult to locate and are usually denied the benefit of operative interference because they do not present a sufficiently conspicuous form of pathological development to attract attention. The loosening of the cicatricial bands which hold the shriveled remains of such imbedded ovaries should no longer be overlooked where the general health of the patient has become desperate and hopeless enough to demand radical measures for its relief.

Plate XXV, Fig. 5 illustrates a uterus to the removal of which must be credited prolongation of life and a restoration of health from a severe form of progressive muscular atrophy accompanied by epilepsy and spinal congestion, with incipient spinal sclerosis. It was a case which had received skillful medical and surgical attention for many years without benefit. The ovaries and tubes had been removed by celiotomy, but only after the removal of a uterus measuring but an inch and a half in depth, and which appeared no larger than the little finger, was the patient's health restored.

With the present limited knowledge of the subject conservatism should prevail and hysterectomy for atrophy of the uterus and its appendages should not be commonly practiced. But it is well to here record the fact that its practice is occasionally demanded. When the operation is decided upon it should be performed by the method already described, and if skillfully accomplished should not draw an ounce of blood or require any form of clamp or ligature. The advantage of this method of performing hysterectomy is apparent. Hemorrhage is exceptional, and when it occurs is controlled by a ligature applied to the bleeding vessel only, without injury to the other tissues. It is applicable to all cases in which vaginal hysterectomy is possible.

Vaginal Hysterectomy—After-Treatment.—After the operation of vaginal hysterectomy it is practically safe for the majority of the cases to sit up on the fourteenth day. Some may leave the bed a few days earlier; many cases, however, should be kept in the recumbent position for another week. The packing should not be permitted to remain in the wound in irritable cases longer than twenty-four hours. In other cases it may be left in position to advantage for three or four days. Where the wound in the peritonium has been satisfactorily closed vaginal douches may be employed as early as the third or fourth day. In cases in which the margins of the peritoneum cannot be satisfactorily secured, and the vagina communicates with the peritoneal cavity, daily plugging of the wound will be needed for a week or ten days, after which the parts may be irrigated. The wound heals rapidly, and sloughing of the tissues only occurs in extreme cases of mal-nutrition. When it does supervene, however, it should receive faithful attention once or twice daily until the wound becomes healthy. No special instructions for the treatment of the wound are needed, as the same principles by which wounds in other parts of the body are successfully treated apply here as well.

The patient should receive neither food nor drink by the mouth for the first twenty-four hours, thirst being quenched by frequently rinsing the mouth with water or by injecting it into the rectum in small quantities. Rectal feeding can also be employed if deemed necessary to sustain the strength of the patient. Should the abdomen become in the slightest degree distended or sensitive an escape for the flatus should be induced by the catheter in the bowel and an early evacuation of the bowels secured. It is well to move the bowels as early as the fourth or fifth day in all cases. They may, however, be moved at an earlier date if peritonitis is threatened. An enema of soap and water will accomplish this for some cases, whereas others will require the administration of a purgative as well. The individuality of the case must always be respected. Some cases can be discharged as early as the third week,



Figure 1. Uterus, Ovaries and Tubes removed intact, through Vagina by Pratt Method, without clamps or ligatures. Ovaries enlarged and cystic tubes chronically inflamed in outer half. Endometrium undergoing Cancerous degeneration. Recovery.



Figure 2. Same specimen as No. 1. Uterus laid open, exposing Uterine Cavity and disclosing ravages of Cancerous degeneration.

while others need attention for four weeks or longer, according to the requirements of the case. The operation is seldom fatal, and if discriminating care be exercised with the view of making a satisfactory record no deaths whatever should be recorded. An operator, however, whose highest ambition is to save life rather than to make a record will many times take desperate chances in attempting to give the patient the benefit of a forlorn hope, and of course sometimes must fail. As experience, however, improves his judgment and develops his technique in this as in all other surgical work his percentages of success will rapidly increase, and that of his failures diminish.

MEDICATION. Remedies will not often be required following vaginal hysterectomy if proper methods have been observed prior to and during the operation, yet in individual instances medication may be called for. If febrile reaction is pronounced aconite, gelsemium and ferrum will be useful, as indicated, and occasionally veratrum viride may be demanded. In some patients there is reactionary fever without sepsis obtaining, and it is here that aconite, belladonna, gelsemium, ferrum and other homeopathic remedies act most beneficially. If for any reason there is a septic feature to the case, arsenicum, china, rhus tox., baptisia or kali phosphoricum may be given with advantage. Chamomilla and coffea, especially the former, are useful in allaying nervous exhaltation and hyperesthesia, while for excessively nervous subjects cannabis indica, mono-bromide of camphor and hyoscyamus are more likely to be needed. For the nausea and discomfort that follow upon anesthesia in especially sensitive subjects ipecacuanha, tabaccum, coccus and apomorphia may be studied to advantage. Arsenicum may also be administered with benefit in the nausea and vomiting following anesthesia in individual cases.

In general the medication of these cases will be the same as that for other post-operative conditions calling for the exhibition of remedies. Usually little if any medication will be demanded.

CHAPTER XXII.

HYSTERECTOMY BY THE ABDOMINAL ROUTE.

Referenda.—The principles upon which the author's method of vaginal hysterectomy already detailed is accomplished are equally applicable in the removal of the uterus, ovaries and tubes by the abdominal route. The form of pathology for which the organs are to be extirpated is of no consequence, as it is believed it is just as simple a matter to remove uterine fibroids, ovarian and other tumors, regardless of their size and complications, as it is to remove smaller specimens of these organs, provided that the underlying principles of this new method be well understood and distinctly followed.

Operation.—The abdomen is to be entered by way of the linea alba at its lower part in the manner common in celiotomies, the intestines are to be walled off from the operating field by sponges or abdominal pads, the uterus is to be sought for and its fundus seized with a double vulsellum or transfixed with a stout guy. One of the ovaries to be removed is now to be grasped by the left hand of the operator and severed from its attachment to the broad ligament, care being taken not to sever the ligament of the ovary, as the entire operation can be performed without separating the ovaries or tubes from their uterine attachments. The dissection, however, must be made close to the ovarian ligament so as to avoid wounding the ovarian artery. Should this accident occur the blood vessel is to be immediately seized by a pair of artery forceps, which for the time being are to be left clinging to the artery. The Fallopian tube is now to be dissected away from the margin of the broad ligament as far as its uterine attachment. No blood of consequence should be drawn in accomplishing this. In exceptional cases where hemorrhage occurs it is to be controlled by the application of one or more artery forceps. A continuous suture of sheep-gut is now to unite the wounded tracks along the broad ligament, caused by the removal of the ovary and its ligament and the Fallopian tube, into a single seam, the thread passing through the outer margin of either wounded track, thus converting the two wounds into one and covering them with peritoneum. When in closing the wound an artery forcep which has been applied to a bleeding vessel is encountered the seam is to be stayed from puckering by inserting two loops of the thread at the same point in close proximity to the artery forcep. As the next stitch passes from the side of its entrance to that of its exit, instead of being superficial in its course and securing the mere margin of the peritoneum, it is to be carried deeply until it has passed under the artery which is grasped by the artery forcep. It is then to leave the tissue. It must not pass through the membrane on the opposite side, but leave the tissue in the middle of the wound close to the artery. It is again to be buried deeply in the tissue on the side on which it first entered, but not catching the edge of the membrane in its descent. It is now to enter the tissues at a sufficient depth to again pass

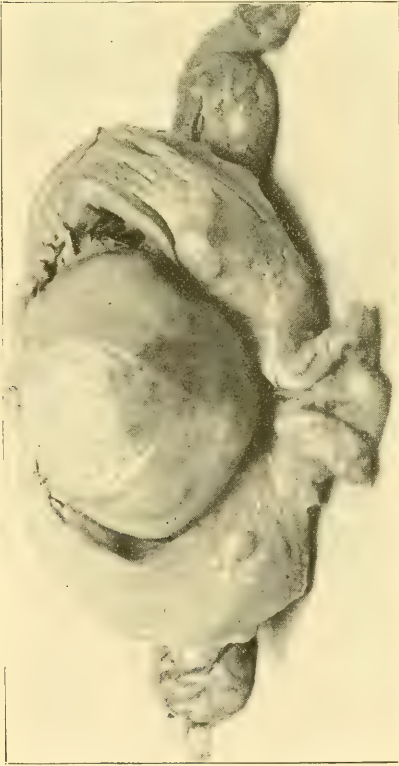


Figure 3. Uterus Split Open Showing Tumor Springing from Dome. —Lee.

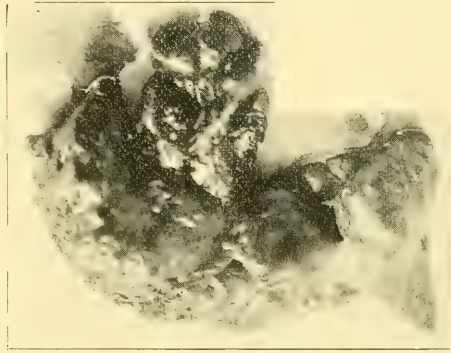


Figure 1. Ovarian Hematoma. —Chislett.



Figure 2. Ovarian Abscess. Chislett.

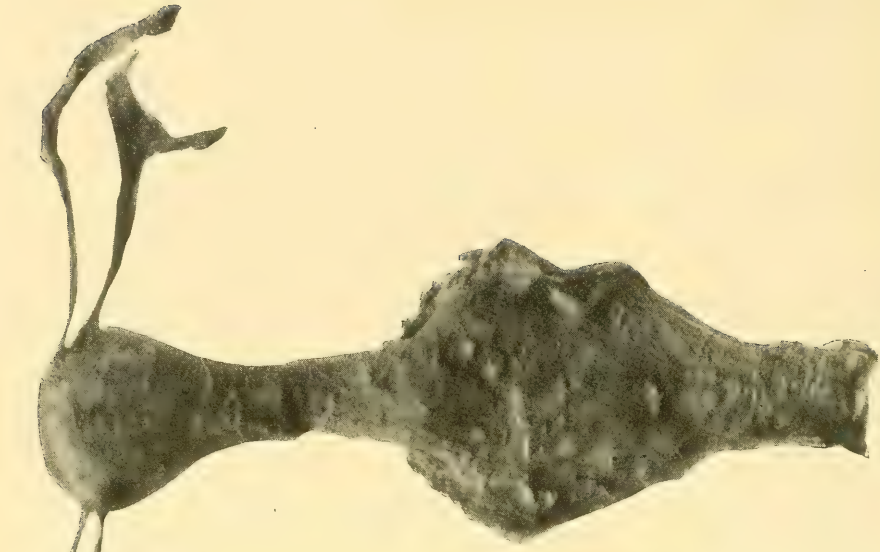


Figure 4. Vaginal Hysterectomy. Extirpation of Appendages and Partial Amputation of Vagina "en masse," Vaginal Tissue Concealing Cervix. —Rosenow. Without Complication. —Pratt.

under the artery, and as it emerges from the opposite side it is to do so by piercing the other margin of the wound. As the thread is tightened it will not only bring together the margins of the wound but by the loop which is thrown around the artery secure a firm grip upon the blood vessel.

The artery forceps are now to be removed when the closing of the wound can be continued as far as the dissection has progressed, namely, to the lateral margins of the uterus. The broad ligament upon that side is now to be dissected from its uterine attachment, the dissection being carried close to the uterine tissue so as to avoid wounding the blood vessels. The continuous suture is to be carried still further, passing downward into the pelvic cavity and coapting the margins of the broad ligaments which have just been severed from their uterine attachment. When the bottom of the wound has been reached, which is located at the point where the uterus is to be amputated, the suture is again to be secured from slipping by a loop passed through the margins of the peritoneum, twice at the same point. While the assistant is making traction upon the vulsellum or guy with which the fundus of the uterus is secured, the operator by grasping the lower part of the uterus between his thumb and index finger now locates the internal os, which can be distinctly felt low down in the pelvis. A large curved needle threaded with heavy silk is made to transfix the cervix just below the internal os. The ends of the thread should be long and be seized by artery forceps for convenience in manipulation. The ovary and tube on the other side are to be severed from their attachment to the broad ligament, the wounded tracks closed by a continuous suture, the broad ligament severed from the uterus, its margins coapted by a continuation of the same suture, and finally the uterus is to be amputated just below the internal os and above the deep stitch which transfixes the cervix. The specimen is now removed and the deep thread is to be immediately tied so as to close the cervical canal.

The amputation of the uterus should be accomplished by the flap method. No hemorrhage will follow the amputation. While the central thread is employed as a guy the continuous sutures on either side are to be carried along the margins of the uterine flaps until they meet in the middle, at which point they are to be tied firmly together. The deep stitch of the silk thread which transfixes the cervix is now to be removed and the operation is complete. No ligatures are needed or applied, no tissues whatever are compressed other than the slight compression exercised upon the margin of the long wound as its edges are held in proximity by a continuous suture. There is no suture employed but sheep-gut, and in this there are but three knots, one at either extremity of the broad ligament where the dissection of the ovary and tube began on either side, and one in the centre of the uterine stump where the two threads were fastened together. Whenever blood vessels have been wounded they have been secured by a loop of the continuous suture being passed around them as described, and as no special ligature has been required their knots are also avoided. Examination of the bottom of the pelvic cavity detects no oozing and all that can be seen is a narrow seam with well coapted margins extending from one side of the pelvis to the other. The Trendelenberg position favors the operation.

Where the case is one of ovarian tumors with elongated pedicles

the operation just described can be varied by severing the pedicles one at a time at any desired point and securing the blood vessels as they are severed with artery forceps. As but one or two will be encountered this is a simple matter. The blood vessels can then be secured by loops of the continuous suture after the manner just mentioned.

Figure 778 illustrates the application of the new suture by means of

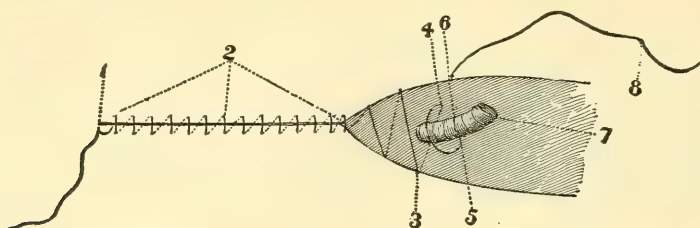


Fig. 778. Continuous Suture—Pratt.

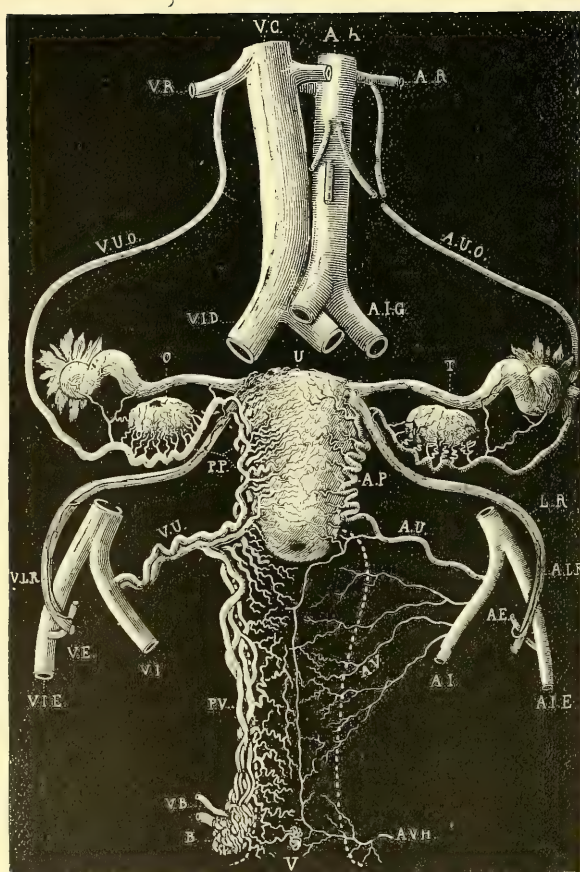
which all pedicle tying and clamping can be safely dispensed with and the attending shock and increased danger of sepsis be avoided.

Sessile tumors are by this method as amenable to treatment as those with pedicles, and the removal of pelvic growths is thus made possible which would be impossible or at least very difficult of removal by any other method. Where adhesions are abundant and the omentum and intestines are agglutinated to the surface of the organs to be removed, making it dangerous to break up the adhesions, enucleation can be practiced, and the same principles successfully carried out to the extreme satisfaction of the operator. Cases operated upon in this manner suffer less pain, less shock, less nausea and a less death-rate than by the methods commonly in vogue.

CLOSURE OF WOUND. In closing the abdominal wound a continuous suture of sheep-gut may be employed to coapt the wounded margins of the peritoneum, another continuous suture of the same material can be employed to bring together the sheaths of the recti muscles, and the wound in the integument may be closed by a third suture of the same material. In closing the wound in the integument it is better to place the stitches beneath the skin by a spiral or continuous suture, running from side to side, than to wound the surface of the skin.

Drainage will be required only in exceptional cases. Where the operator prefers to remove the cervix as well the vaginal attachments, the cervix should first be severed by way of the vagina, after which the operation can be proceeded with as described, the vaginal vault being closed from the peritoneal side by means of the continuous suture already described.

Surgical Necessities of the Outlets of the Body.—The fact that the outlets of the body are sphincter-guarded adds an important consideration which complicates all surgical procedure upon the pelvic organs. Sphincters grip tightly upon irritable conditions of their lining membrane as well as upon foreign substances, and thus squander the vitality of the body in two ways; one by the nerve power which it costs to hold a muscle in a continuous state of excessive contraction, and the other by the undue pinching of sensitive terminal nerve fibres thus occasioned. As the outlets of the body are double sphincter-guarded—



Schema of the Genital Circulation (Auvard and Devy).

A. A., Aorta; V. C., Vena Cava; A. R., Renal Artery; V. R., Renal Vein; A. U. O., Ovarian Artery; V. U. O., Ovarian Vein; A. I. C., Left Common Iliac Artery; V. L. D., Right Common Iliac Vein; A. I. E., External Iliac Artery; V. I. E., External Iliac Vein; V. I., Internal Iliac Vein; A. E., Epigastric Artery, giving off A. L. R., Artery of the Round Ligament (L. R.); V. E., Epigastric Vein receiving V. L. R., Vein of Round Ligament; A. P., Puerperal Artery; P. P., Pampiniform Plexus; A. U., Uterine Artery; V. U., Uterine Veins; A. V., Vaginal Arteries; P. V., Vaginal Plexus; A. V. H., Vulvo-Vaginal Branch of the Internal Pudic Artery; V. V., Veins emptying into Internal Pudic Vein, and also into External Hemorrhoidal Veins; B., Bulb of Vagina; V., Vulva; U., Uterus; T., Fallopian Tube; O., Ovary—Wood's Gynecology.

the lower set of muscles being of the voluntary type and supplied by the cerebro-spinal system, and the other of the involuntary type and supplied by the sympathetic—the nerve-waste can tax either or both nervous systems, according to the location of the point or points of irritation upon the mucous membrane lining whatever outlet is involved.

Bone and joint affections, as well as serious inroads upon the integrity of the softer parts, are possible only as products of mal-nutrition, and can only exist as a result of insufficient nerve-force with which to properly propel the enginery of the body. In delicate cases, therefore, which, in addition to their weakened general condition, are afflicted with serious local affections demanding some form of major operation, the first consideration of the surgeon should be given to locating the point or points at which the prodigal expenditure of nerve-force lies, and an effort be made to stop the waste and secure an increased accumulation of vitality with which to sustain the shock of the major work and lay a foundation for a successful issue of the surgical interference. This will involve in all cases of chronic pathology, wherever located, a careful examination of the outlets of the body. Tight sphincters will be found gripping upon minute as well as magnified forms of disorganized membranous linings. Atrophied conditions encountered in the last inch of the rectum and in the various openings connected with the sexual organs of either sex are invariably prolific sources of nerve waste, the correction of which, by judicious pruning and dilatation, exercises a remarkably stimulating effect upon all bodily activities, stimulating increased nutritive changes, both local and general, throughout the body.

Orificial surgery will thus be seen to sustain an important and practical relation to general surgery, and the surgeon in his zeal for an exhibition of skill, locally applied, should never forget the unity of the human body and the deep-seated underlying causes of the local difficulty to which his attention has been called.

The orificial philosophy and the surgical methods of applying it to the cure of chronic diseases are subjects not pertinent to the purposes of the present volume, and are thus briefly referred to only because all surgical procedures applied at the outlets of the body exercise such a profound action upon respiration, circulation and nutrition that their influence upon general conditions should never be lost sight of.

A speculum should not be retained long at a time in a sensitive rectum, but should be frequently withdrawn and again inserted to avoid too profound an effect upon the respiratory organs. For this reason, if no other, hemorrhoids should never be removed by ligation. A plug should never be left in a rectum for any considerable length of time after an operation. The effect of dilatation of the vagina, or of the uterus, or of the urethra in either sex should be carefully noted, and the rapidity and thoroughness of the work adjusted to the effect produced. The length of time for the retention of uterine packing, or stem pessaries, or urethral sounds must be gauged by their general as well as their local effect, and everywhere and at all times surgery of the orifices should be accompanied by their dilatation, and unusual attention should be given to the maintenance of cleanliness and the avoidance of painful measures.

Orificial operative aid is often a valuable preparatory measure for major operations, and will many times dispense with them altogether.

SECTION XXVI.

TUMORS.*

CHAPTER I.

CLASSIFICATION.

Definitive Considerations.—The meaning of the word “tumor” is much more restricted at the present time than it was a quarter of a century ago, when every swelling coming under the eye of the surgeon was called a tumor (tumor-swelling.)

The advances made of late years in pathological histology through the labors of Virchow, Thiersch, Cohnheim, Waldeyer, Ranvier, Sutton, Butlin and others, the exclusion of those growths from the definition which are known to be produced by micro-organisms, as tubercle, actinomycosis, hydatids, etc., the proper understanding of inflammatory new formations and granulation tissue, together with a more precise nomenclature, have much curtailed the application of the term, which doubtless will, as investigation proceeds, have even a more limited signification.

A tumor (neoplasm), then, is a new and useless growth, with inherent power of development within or upon the body, composed of cell elements the similarity or dissimilarity of which to the normal histological elements found in healthy adult human structures renders it either “innocent” or “malignant.”

It may further be said that the nearer the cells of a neoplasm resemble those of healthy structure the more bland is the tumor, and the closer they approach embryonic cells the more malignant they become. This definition does not apply either to inflammatory new formations or to granulation tissue.

Distinctive Considerations.—The exudations of inflammatory processes may be mistaken for tumors but these generally disappear as soon as inflammation subsides, or, if they remain they constantly tend to dissimulate themselves as healthy tissue. Tumors, on the contrary, continue to grow more or less steadily, with or without inflammatory action, and often deviate more and more from the normal type. In rare instances they may be confounded with aneurisms and abscesses; but the history of the case, a careful study of the symptoms, or, if these fail, a cautious use of the exploring needle or the aspirator, will render the diagnosis more certain. The surgeon should, if prepared to be precise, exclude from the

*The microscopical appearances detailed in this chapter have been prepared by Geo. F. Laidlaw, M. D., Lecturer on General Pathology in the New York Homeopathic Medical College and Hospital. The drawings were also made by Dr. Laidlaw from sections prepared by himself, many of them from the author's specimens.

classification, all retention cysts, extravasations, tubercle, gummata, farcy buds, and effusions.

Nomenclature.—Ever since Müller, in 1838, attempted the arrangement of tumors according to their histological elements the study of oncology has been surrounded by many difficulties, and although Virchow in 1847,* again in 1851†, and still again in his great work in 1863‡, laid the foundation of a more precise classification and nomenclature there have been and still are many obstacles to the formation of any hard and fast lines in the arrangement of tumors.

It may be said here that these difficulties do not apply to the so-called innocent growths, but to those known as the sarcomata and the carcinomata. The terms homologous and heterologous, in this book, will stand respectively to represent innocent and malignant growths, after the manner of the English schools,§ and not according to the arrangement of some of the German pathologists.

The latter assume that a homologous tumor is one of a similar character to the tissue from which it springs, while a heterologous growth is one possessing different characteristics from that from which it grows. It will be seen that such an arrangement would render a tumor of definite construction homologous in one portion of the body and heterologous in another; and as even in this classification of Virchow the heterologous growths are generally found to be cancerous and the homologous innocent tumors, it seems better, to save confusion, to at least have one portion of the classification definitely arranged.

Again, in this Section the term semi-malignant will not be employed as belonging to the sarcomata. From a large experience the author may say that embryonic connective tissues develop tumors quite as and, in some instances, more malignant than those of epithelial origin, and although Gross,** Butlin†† and others have attempted to show that the recurrens in loco eodem alioque, so eminently characteristic of cancer, is not so persistent nor so general in the sarcomatous growths, the author's observations indicate that the latter recur and kill with as much certainty as the former, and he does not think sufficiently reliable data have been arrived at to pronounce upon a question surrounded by so many difficulties. The old terms "scirrhus," "encephaloid," "epithelioma," etc., will be employed in the classification which is to follow, as synonyms to the newer nomenclature, in order that the student may understand to what varieties of tumors the older surgeons applied these names and to appreciate the terms when they are met with in other books.

The tissue origin of tumors is here adopted, taking as a starting point the blastodermic membrane—premising always that there are many difficulties in this structural classification, occasioned by the overlapping of one variety into the other, and the different degrees of degen-

*Virchow's Archives, Vol. I.

†Loc. cit. Vol. III.

‡Die Krankhaften Geschwülste. 1863.

§"There is one class in which the substance of the tumor has an exact anatomical resemblance to some tissue of the body (homologous tumors.) There is another class of tumors which do not present any resemblance to the normal tissues, and are therefore described as heterologous." Holmes Principles and Practice of Surgery, p. 348.

"The intimate structure of malignant tumors is usually not like that of any of the fully developed natural parts of the body. Innocent tumors have not a structure widely different from that of natural tissue." Lectures on Surgical Pathology. English Edition. pp. 382-387.

**Sarcoma of the Female Breast. American Journal of Med. Science, July, 1887. Sarcoma of the Long Bones. American Journal of Med. Science, July, 1889.

††Sarcoma and Carcinoma, etc., by Henry Trentham Butlin, F. R. C. S., London, 1882. Operative Surgery of Malignant Diseases, Ibid, London, 1887.

eration which are now known to take place in all neoplasms whether innocent or malignant.*

Diagnostic Considerations.—As a means of diagnosis between innocent and malignant tumors (primary diagnosis is, of course, meant), the microscope is of little practical use; after their removal from the body their characters and peculiarities are better determined. How much better would be this condition vice versa! The author is therefore disposed to agree with Savage in the introduction to the third edition of his work when he says: "The question of malignancy is not to be determined histologically," and further when he writes: "In regard to the question of malignancy, the experienced surgeon decides without much reference to histology, and is generally right where the pure histologist is generally wrong." The greatest benignity and the greatest malignancy may be united in the sarcomatous group. I can assure you that two sarcomata of the most similar histological quantities may differ entirely in course (Billroth).

The operating surgeon must make his diagnosis before the tumor is cut out. The microscopist in most instances renders his decision after the removal of the neoplasm. The clinical classifier must be entirely influenced by the presenting symptoms, while the variety, position, shape and arrangement of cells are the guides for the microscopist.

The microscopist, however, can and does materially assist the surgeon in two ways:

First. When he can examine a portion of the tumor before operation, which frequently is possible in cystic, villous, papillomatous growths and those others found in the accessible cavities.

Second. By comparing the results of his investigations of post-operatives specimens with the clinical symptoms, as noted by the surgeon, thus enabling the latter, should a similar case present, to be more precise in diagnosis and accurate in prognosis.

Arrangement.—The very simplest classification of tumors at the present is that lately presented by Sutton† who makes four grand divisions.

First. Connective tissue tumors.

Second. Epithelial tumors.

Third. Dermoids.

Fourth. Cysts.

His subdivisions are, however, very numerous. Taking all the different arrangements into consideration, the author has adopted the following—as the most simple and comprehensive:

Clinical Classification.—Classifying tumors clinically, it may be said that there are two great typical divisions, viz., innocent and malignant (carcinoma), as a rule, and with an understanding of the fact that one division may overlap the other.

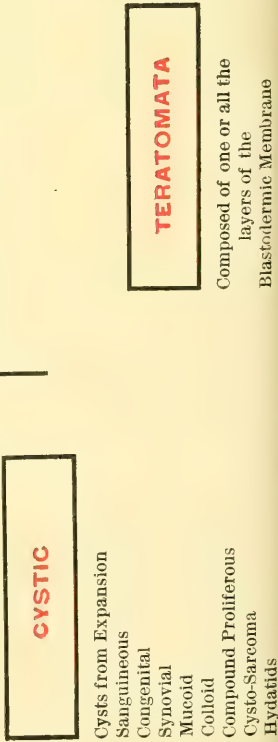
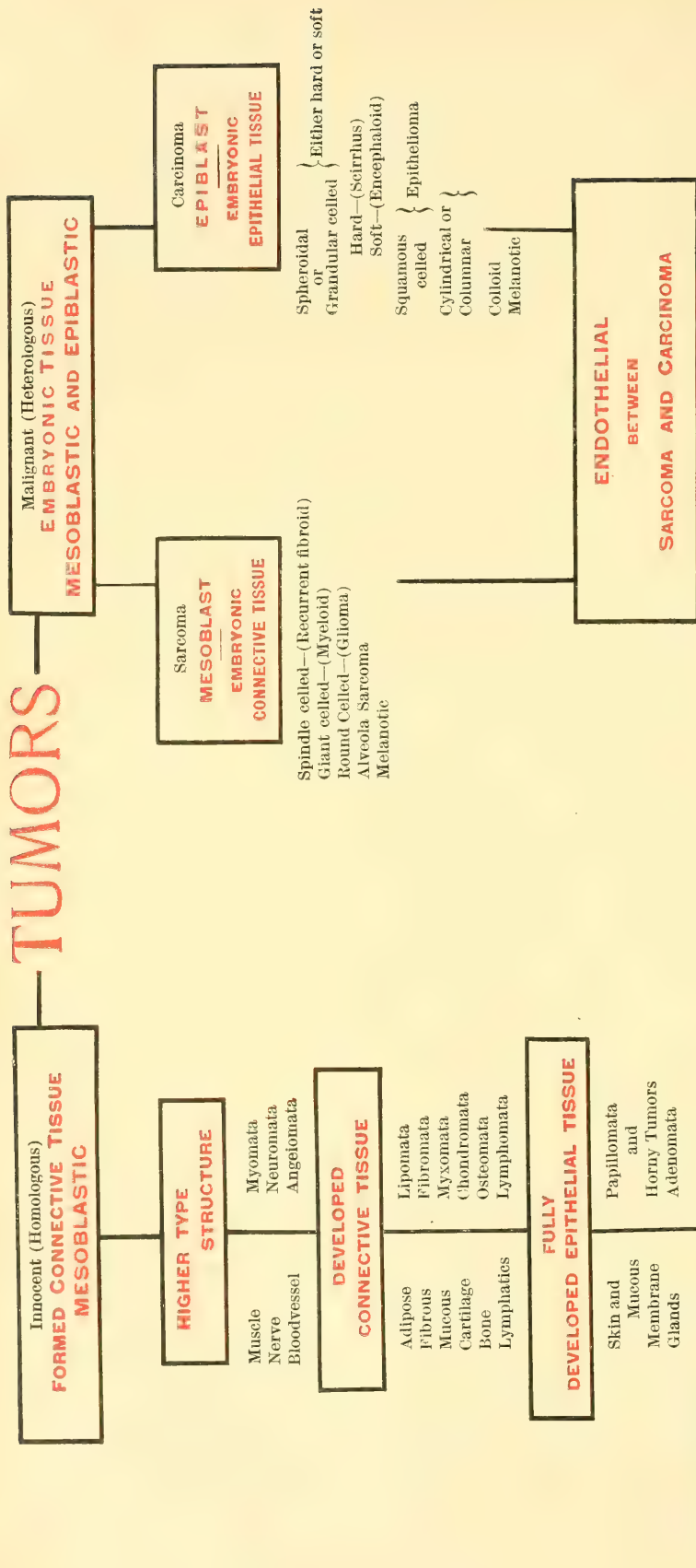
Innocent tumors may be distinguished by the following characteristics:

First. They are harmless in reference to surrounding structures.

*It was formerly supposed that an innocent tumor could not degenerate to malignancy, and that a malignant tumor was malignant from the beginning to the end. This doctrine I taught for many years. Bryant writes, "Tumors never change their original nature nor pass or degenerate into others of a different kind. A simple tumor remains so to the end. A cancerous tumor is cancerous from the beginning." Bryant's Surgery, Roberts' Edition, page 88.

†Tumors, Innocent and Malignant, by J. Bland Sutton, Phila. Lea Brothers, 1893.

TUMORS



Second. They are not liable to return after proper extirpation.

Third. In texture they resemble the normal adult tissues of the body.

Fourth. As a rule they are unattended by any marked constitutional disturbance.

The following diagnostic marks characterize malignant growths:

First. In microscopic structure they completely differ from normal and fully developed tissues of the body.

Second. They are disposed first to soften, then to ulcerate, and there is a great tendency to infiltration and destruction of the surrounding matrix; this infiltration may be either slow or rapid.

Third. They do not enlarge continuously, but become irregular and lobulated with offshoots.

Fourth. They are marked by persistent and sometimes fatal hemorrhage.

Fifth. The fetor is always easily recognized and is sometimes intolerable.

Sixth. They have a tendency to invade all surrounding structures, to produce secondary deposits and to sympathetically involve distant organs.

Seventh. They are liable to return after extirpation.

Eighth. They produce constitutional cachexia.

Differentiation Between Innocent and Malignant Tumors:

INNOCENT.	MALIGNANT.
1. Harmless with reference to the surrounding structures.	1. The tumor is apt to destroy or involve surrounding structures.
2. Texture bears some resemblance to certain of the surrounding structures.	2. Texture differs from the normal structure of the human body.
3. Non-liability to return.	3. Great disposition to return.
4. Absence of hemorrhage.	4. Liability to bleeding.
5. Little disposition to soften.	5. Great tendency to soften.
6. Not much tendency to ulcerate.	6. Great tendency to ulceration.
7. Rarely accompanied by offensive discharges.	7. Very offensive, ichorous, or bloody discharge.
8. Non-infiltration of surrounding structures.	8. Infiltration of the part on which they grow, which is often entirely transformed.

Innocent and malignant growths may coexist in separate tissues in the same individual and the innocent may become malignant, if a cancerous cachexia is present in any part of the body.

Characteristics.—Tumors may occur in any part of the body. As a rule, malignant growths attack most frequently the glandular organs, while benign tumors generally affect the skin, cellulo-adipose tissue, nose, uterus, and ovary.

FORM. In form they vary greatly; they may be smooth, lobular, round, conical, uneven, etc. Tumors involving lymphatics are generally nodular and irregular; encysted and fatty tumors are smooth and globular. Situation may modify the shape, especially if the tumor be bound down by fascia or muscular tissue.

VOLUME. In volume they range from the size of a millet-seed to a bulk almost as great as the patient's body.

COLOR. The color varies with the number of blood vessels contained in the growth, and also with the amount of inflammatory action in the tumor itself, or in the superimposed tissue. Nevus is generally purple ;

fatty tumors, yellow; fibrous, whitish; cartilaginous, white and glistening. Sometimes from over-distension of the skin, especially in pendulous tumors, inflammation and suppuration of the integument take place. In some cases this has given rise to a mistake in diagnosis; the inflammation being mistaken for infiltration, and malignancy suspected. It sometimes also happens, especially in the pendulous variety, that other growths of entirely different histological formation are found. Fig. 779 represents a large pendulous tumor of the abdomen, in the center of which a spindle-celled sarcoma was found.

CONSISTENCE. In regard to consistence, tumors may be hard, soft, or semi-solid; fibroid and certain forms of spheroidal-celled carcinomas are hard; cystic, soft; and the fatty tumor has a "feel" between fibroid and cystic. Occasionally the position of a tumor and its confinement by fascia gives it a sense of pulsation, which might lead to the supposition of aneurism.

MOBILITY. The mobility of a tumor depends upon its situation and the character of the tumor itself. Some, like the fatty tumors, are freely movable; others, like the exostoses, are always firmly attached. Consistence and mobility, however, can give us but little idea of the true character of the tumor.

METASTASIS. Cohnheim has endeavored to settle the question as to the metastasis of tumors by actual experiment, which consisted in detaching a small piece of periosteum from the tibia, and then introducing it into the jugular vein. At first he found considerable difficulty from the ordinary mechanical and surgical results of such an operation; but, by using Esmarch's method, combined with all antiseptic precautions, he succeeded and the animals lived quite well. They were killed after various periods, by bleeding. In those killed from the third to the fifth day only embolized periosteum was found; in those from the tenth to the sixteenth day a resistant, hard place on the lung parenchyma existed; in those after the twentieth day the results were quite negative. Microscopically examined the masses found between the tenth and sixteenth days were true growths of the periosteum, with commencing formation of bone; but in cases where more time had elapsed the new growth was seen to be undergoing absorption and after a month had entirely disappeared. He judges from this that the only plausible theory is that either through the medium of the blood vessels or of the lymphatic systems morbid cells are carried to remote portions of the body, where they are

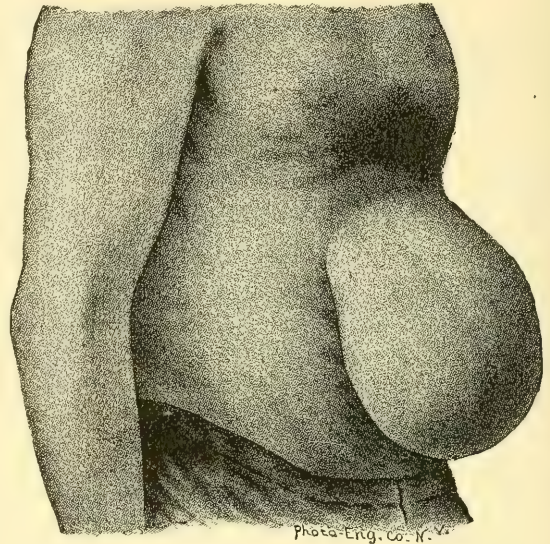


Fig. 779.
Pendulous Lipoma, Containing Sarcomatous
Growth in the Centre.—Helmuth.

arrested in their progress by some peculiar adaptiveness of the tissue to the propagation of the cell.

GROWTH. The first formation that is noticed in the growth of a tumor is a minute mass of protoplasm, consisting of a small round cell with an irregular nucleus, the product of the connective tissue corpuscles.

Whether, however, it is the stable or the mobile cells that are the factors in the production of this protoplasm, or whether both assist in the formation, has not yet been determined. This protoplasm bears an exact resemblance to the embryonic cell and at this period of development it is impossible to decide whether the neoplasm is to be innocent or malignant; if as the tumor grows it takes upon itself the nature of fat, fibre, flesh, or other healthy adult tissue, the growth, without doubt will be innocent; if on the other hand a proliferation of similar embryonic cells takes place, if they do not proceed to any complete formation, if they are irregular, broken-down masses of embryonic tissue largely supplied with blood vessels, then the tumor will assume one of the many forms of carcinoma. If there is an effort at organization, and here and there throughout the mass are the evidences of a higher development, then the growth may be set down as a sarcoma.

CAUSATION. With reference to the causation of neoplasms very little is certainly known. Heredity and local predisposition have been assigned as causes. The fact that certain tumors are developed during fetal life, as nevi, congenital cutaneous cysts, certain bony and cartilaginous tumors, as well as those growths arising from arrest of development, as certain cysts, (spina bifida, meningocele), warts, moles, cracks and fissures, have given rise to the embryonic theory of tumor-etiology. Heredity, especially in malignant growths, has by no means entirely departed from the factor list, especially if local irritation be present. The traditional hot stem of the clay pipe, or the frequent irritation of a ragged tooth, exemplify this theory.

The recognition of sporozoa and sporosperms in pathological formations have led to careful investigation, and the parasitic origin of cancer is now attracting great attention* and is being ingeniously defended; some investigators, however, holding that the sporozoa are nothing more than degenerate epithelial cells.† The auto-infection of cancer is another subject of dispute among pathologists, and on this theory the author is disposed to agree with Shattock, F. R. C. S., who contends that cancer inoculation and experimental transition to inferior animals is impossible.‡

Perhaps the most plausible theory, after all, is that unutilized embryonic tissues (which may be divided into vestiges and rests) remain undisturbed in the system until some irritation causes them to take on growth, and assume in some instances large proportion. By the term "vestige" is understood those portions of the body which may be of use during the embryonic life but are of no service after birth; or those which may be rudimentary in one sex and complete in the other. By the term "rest" is meant portions of glands that are offshoots or accessory to organs, or small portions of epithelium which have been enclosed in growing tissue.

*Cancer, Sarcoma and Other Morbid Growths Considered in Relation to the Sporozoa, by J. Jackson Clarke, M. D., F. R. C. S. E., p. 97, London, 1893.

†Medical Record, July 21st, 1894.

‡The Morton Lecture on Cancer and Cancerous Diseases, British Medical Journal, May 19, 1894, p. 1065.

For a further discussion of the parasitic origin of cancer the reader is referred to an article by Dr. Geo. F. Laidlaw, N. A. Journal of Homeopathy, May, 1895.

CHAPTER II.
INNOCENT TUMORS (HOMOLOGOUS.)
HIGHER TYPE STRUCTURE.
CONNECTIVE TISSUE.

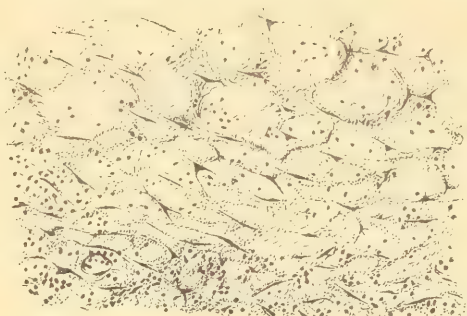
Myomata.—A tumor composed of true striated muscular fibre is so very rare that its existence is denied by many pathologists,* while others, as Green,† allow them to have existed in a few cases, but, as such, declare that the growths were congenital. Tumors, however, are frequently found which possess—often in considerable quantity—(rhabdomyoma) striped muscular fibre. These neoplasms are generally located in the testicle and ovary, and being frequently associated with the remnants of other tissue, such as cartilage, hair, bone, etc., should be, according to strict histological classification, placed under the second division, or that variety arising from the fully-developed connective tissue series. Smooth, muscular tumors of unstriped muscular fibre (leiomyomata) are often associated with fibrous material, and are chiefly developed in the uterus, and it is a matter of surprise how well the body tolerates the growth of these neoplasms. The size they attain is sometimes enormous; the age at which they appear is about the adult period, and colored women are peculiarly liable to them. In some instances there is a large association of blood vessels, causing the profuse bleedings which are characteristic, and from which they have been termed myo-angiomas, or “red” fibroids‡ (Fig. 780). In the majority of instances the fibrous connective tissue is predominant, and from the specimens which the author has had examined, it is believed that the true nature is that of myo-fibroma, rather than true myoma. The diagnosis is readily made out and the treatment is by the knife. Hysterectomy, both vaginal and supravaginal is now performed with great success, but the operation is always more or less dangerous and in inexperienced hands is liable to prove fatal. Oöphorectomy is more readily performed, and often succeeds in arresting growth of the leiomyoma and in arresting hemorrhage. The author has known myo-fibroma to gradually disappear after the removal of the ovaries and tubes.

a. **MICROSCOPIC APPEARANCES.** Rhabdomyoma. The microscopic appearance of striated muscle fibre, stained, is represented in Plate XXXIX, Fig. 4. Such a fibre may resemble a dense bundle of connective tissue fibres, the distinction between the two being made by the presence of delicate transverse striations on the muscle fibre. On careful examination with a high power (300 or more diameters), the striations are seen to be made by alternate broad (Bowman’s discs) and narrow (Krause’s membrane) lines. There are also longitudinal striations which represent the ultimate fibrillæ. Here and there along the fibre are located the nuclei of the sarcolemma. Bits of voluntary muscle adherent to or in-

*Heitzmann; Microscopical Morphology of the Animal Body. New York, 1883, p. 517.

†Pathology and Morbid Anatomy, p. 162.

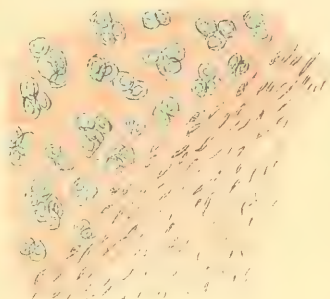
‡For further information regarding these tumors the student must consult the chapter on Surgery of the Uterus.



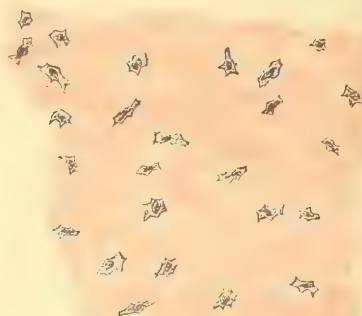
1. Mixture from Pharynx, $\times 100$



2. Fibroma of Skin, $\times 300$

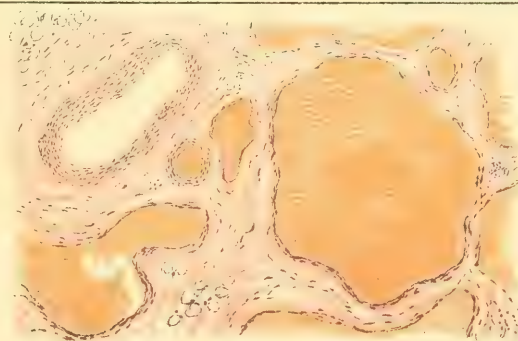


3. Chondroma $\times 300$

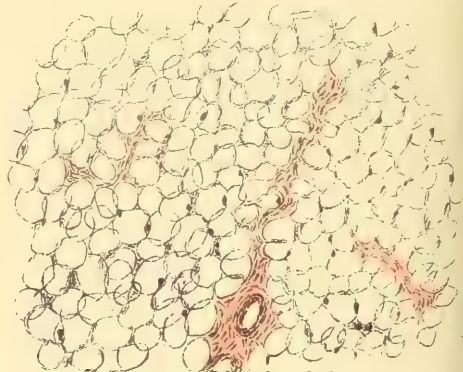


4. Striated Muscle Fibers $\times 300$

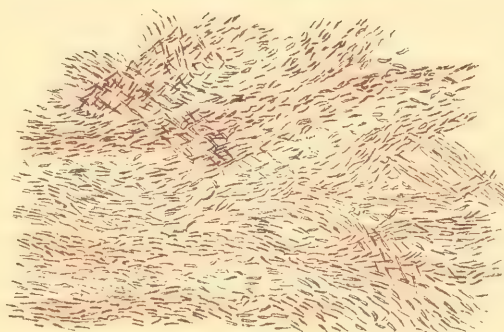
5. Osteoma $\times 300$



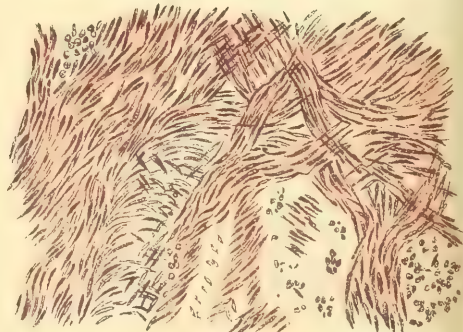
6. Cavernous Angioma of Wrist $\times 50$



7. Lipoma of Back $\times 100$



8. Myoma of Uterus $\times 100$



9. Myoma of Uterus $\times 300$

Laidlaw.

PLATE XXX.

CONNECTIVE TISSUE TUMORS

HARDENED IN ALCOHOL. STAINED WITH HAEMATOXYLIN AND EOSIN AND MOUNTED IN CANADA BALSAM

cluded in a rapidly growing tumor should not be mistaken for muscle fibres of new formation. The location and gross appearance of the tumor will guard against this error.

b. *Leiomyomata* (vide Fig. 780), or smooth muscle fibre tumors, are found, under the microscope, to be composed of a mixture of smooth muscle fibre and fibrous connective tissue in various proportions. In sections stained with hematoxylin and eosin (Plate XXX, Figs. 8 and 9), the bundles of smooth muscle fibre appear as deep red masses, which are thickly dotted with purple, rod-shaped nuclei. In some places the bundles run in broad parallel bands; in others, they cross and interlace in every direction. The bundles of smooth muscle fibre are separated by a variable amount of fibrous connective tissue which takes the eosin stain much more lightly than the muscle, sometimes even taking no stain at all. Blood vessels run in the fibrous tissue. They may be very scanty, or, on the other hand, so numerous as to warrant the designation of cavernous or telangiectatic myomata given them by Virchow. The walls of the blood vessels are bound firmly on all sides to the fibro-muscular tissue of the tumor, so that when the tumor is wounded profuse hemorrhage results from the inability of the vessels to contract. In old myomata the fibres are sometimes much in excess of the muscular tissue. Such a tumor becomes a myo-fibroma.

The leiomyoma must be distinguished from fibroma and from small spindle-celled sarcoma. Comparison with fibroma (Plate XXX, Fig. 2) shows that the myoma has not the tangled, hair-like fibres of fibroma; and that where the fibrous tissue runs in dense bundles the purple spindle corpuscles are few, whereas in myoma the purple nuclei of the muscle spindles are very numerous. The nuclei of the myoma are rod-shaped, those of the connective tissue corpuscle of an oval or spindle form.

Differentiation from small spindle-celled sarcoma (Plate XXXII, Figs. 2 and 7) may, at first, present some difficulty; especially where, as in Plate XXX, Fig. 9, the myoma presents bodies that look like small, round cells mingled with muscle spindles. These round forms are simply cross sections of muscle fibres which sometimes include the nucleus and sometimes do not. Both small spindle-celled sarcoma and myoma are composed of nucleated spindles. It is to be noted however that the nucleus of the sarcoma spindle is oval and rather broad; whereas, the nuclei of the smooth muscle fibres are long, narrow and rod-shaped, that is, their borders are parallel. If the diagnosis should be uncertain in regard to a particular field careful examination of adjoining fields will certainly reveal the typical nuclear figures, as pictured in the plates.

Neuromata.—There are three subdivisions: First. Neuro-fibroma. Second, plexiform neuroma. Third, traumatic neuroma. The neuromatous tumor is also embraced under the head of fibroma (neuro-fibroma). In such growths, according to Paget and More, “it is impos-

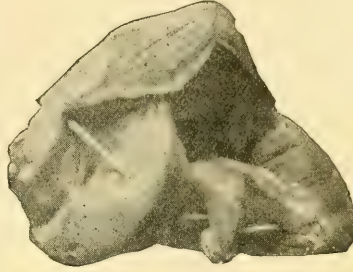


Fig. 780.
Fibroma, Containing a Myoma. The Internal Tumor was Blood Red, Contrasting Strongly with the White Glistening Interstitial Fibrous Tissue.—Hel-muth.

sible to distinguish the fibrous neuroma from that composed of nerve elements." It exists singly, or there may be hundreds in different parts of the body. In color neuromata are grayish, or yellowish-white, and are said to arise *from a deposit of lymph around a single nerve fasciculus, which becomes organized, while other deposits take place until a fibrous growth results. These tumors are sometimes excessively painful when handled, but at others are not so; sometimes the pain shoots along the course of the nerves and at others there is coldness of the part, and sometimes a great loss of sensibility. True neuromatous tumors are very rare; the ordinary variety nearly resembles the cerebro-spinal nerves, from which it often grows.

These growths, however, must not be confounded with the "painful subcutaneous tumor of Wood." This is a peculiar growth of fibrous structure situated underneath the skin, occurring more frequently in women than in men, varying in size from a pea to that of a chestnut. These tumors are round, rise a little above the surrounding integument and are most intensely painful, giving rise to hysterical symptoms of the most violent character. They are generally incased in a capsule of moderate firmness but are not imbedded between the fasciculi of nerves, or beneath the neurilemma, hence they must not be confounded with the neuroma just mentioned. On section this variety of fibroid tumor presents fibres matted together and interlaced around a nerve trunk. Sometimes there is a concentric arrangement of fibres, especially if treated with nitric acid.

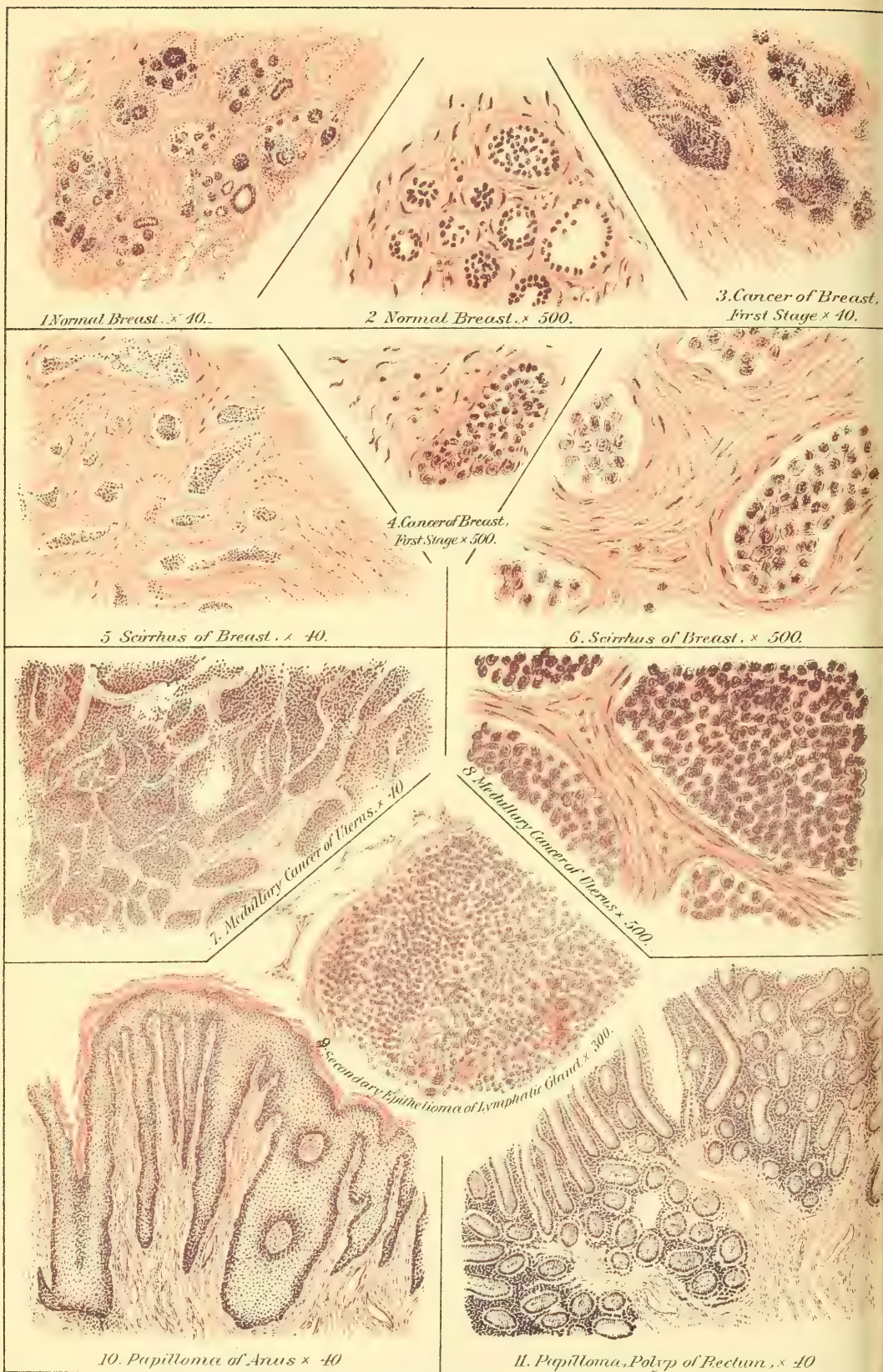
TREATMENT. Of the medicines internally administered, those which have been productive of most good are undoubtedly conium and calcarea. However, of late years the author has generally resorted to operative measures. The internal administration of the muriate of ammonia has been productive of good, and to relieve pain the hypodermic injection of a few drops of a four per cent. solution of cocaine has been very efficacious. The application of veratrine ointment along the course of the nerve is often of great service. For traumatic neuroma the best medicines are allium cepa, belladonna, arnica and conium.

MICROSCOPIC APPEARANCES. a. Fibromata or myxo-fibromata which occur in the course of a medullated nerve: The tumor grows from the connective tissue framework of the nerve, insinuates itself between the nerve fibres and spreads them out. Sections taken from the centre of the tumor usually show nothing but fibrous tissue with occasional areas of myxomatous degeneration, and, in large tumors, there may be cysts. Sections from the periphery will exhibit cross sections of medullated nerve fibres, which in hematoxylin and eosin preparations must be carefully searched for as round, glistening, unstained bodies with a central dark spot, the axis cylinder. They look somewhat like unstained small round cells.†

b. Plexiform or "tendril-like" neuroma has been described by Bruns and others. It is a true neuroma in which the branches of a medullated nerve, usually a subcutaneous nerve, are thickened and elongated; many new nerve fibres are formed and there results a mass of tortuous fibres which resembles, clinically, a group of varicose veins.

*Holmes's System of Surgery, Vol. I, p. 527.

†For special methods of staining to demonstrate the nerve fibres see Kahlden's "Methods of Practical Histology." Macmillan & Co.



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PLATE XXXI

EPITHELIAL TUMORS

HARDENED IN ALCOHOL. STAINED WITH HAEMATOXYLIN AND EOSIN AND MOUNTED IN CANADA BALSAM.

c. Traumatic or amputation neuromata include the small, bulbous expansions which are nearly always found on the ends of nerves in an amputation stump. After the amputation there is first a proliferation of the peri- and endoneurium, which forms a bulb of young fibrous tissue. The axis cylinders grow down into this bulb, and sometimes are found coiled up in a ball within it. They subsequently become invested with a fibrous and medullary sheath. This process is simply an attempt on the part of the nerve to reunite its severed ends, and, as Green remarks, is rather a thwarted effort at regeneration than a true neoplasm. Similar bulbs are found on nerves which have been wounded in other ways than by amputation. (Sutton.) It should be remembered, however, that spindle-celled sarcomata sometimes grow from a nerve trunk, and that these tumors possess the malignant character of sarcomata, generally.

Angeiomata.—Vascular tumors, as their name implies, are those composed of blood vessels. They are divided into three varieties: first, simple capillary, or nevi; second, cavernous angeioma; and, third, plexiform angeioma or aneurism by anastomosis.

Vascular tumors are found generally in the subcutaneous tissue, and then are called nevi. When they are large and composed chiefly of arteries they receive the name cavernous angeiomata, and if composed of many vessels they later become aneurisms by anastomosis. This variety of tumor varies in size; is soft and compressible, often distinctly pulsating; is irregular in shape, and if very well supplied with blood-vessels gives a distinct bruit. As it grows the skin may be so overdistended that imperfect nutrition results and ulceration opens the tumor, from which there is often profuse hemorrhage. On the scalp, in the lip, and about the face they are often found. The author has seen them on the cheek, the forehead and even on the back. The simple angeioma is generally a mark.

The diagnosis of this variety of tumor is usually easy, although Holmes mentions a case in which a pulsating cancer of the skull (supposedly a cavernous angeioma) was mistaken for aneurism by anastomosis; the patient was operated upon and nearly lost his life on the table. Sometimes the tumors may be dissected out. It may be mentioned here, however, that in the treatment of these small tumors, even when there is considerable pulsation, the author has succeeded well by injecting from forty to sixty drops of the fluid extract of ergot into the tumor, as recommended by Hammond. In two instances the injection was repeated after a lapse of eight days.

MICROSCOPIC APPEARANCES. Two varieties of angeioma are recognized microscopically: a, Simple capillary or telangiectatic angeioma; b, cavernous angeioma. (Plate XXX, Fig. 6). Simple angeioma on section appears as a mass of capillary blood vessels, many of which are tortuous and sacculated, separated by a varying amount of fibrous connective tissue. Sections of arterioles are also seen. Many of the vessels present are simply dilatations of pre-existing capillaries (Ziegler)—others are newly formed.

Cavernous angeioma (Plate XXX, Fig. 6) simulates the structure of the corpus cavernosum penis. It presents irregular spaces filled with clotted blood, which in stained sections appears as an orange-red mass.

With the higher powers (300–500) the outlines of the red corpuscles are plainly seen. The cavernous spaces are lined with endothelia, which are not visible with the magnifying power at which this drawing was made. The appearance of endothelia under higher powers is shown in the capillaries represented on Plate XXXII, Figs. 1 and 8. The endothelia appear as a narrow black line, which represents the bodies of the endothelial plates seen on the edge. Here and there small, flattened, purple knobs project inward. These are the nuclei of the endothelia. The blood spaces of the angeioma are separated by narrow fibrous septa, which contain a variable amount of smooth muscle fibre, and sometimes, as in the case of the tumor illustrated here, a few fat cells. The tumor is supplied by one or more arterioles, which open directly into the cavernous spaces. A slanting section of such an arteriole is shown on the left side of the picture, its deep red wall of involuntary muscle fibre distinguishing it from the surrounding fibrous connective tissue.

LYMPHANGEIOMATA. These have practically the same appearance as blood angeiomata, except that the vessels do not contain red blood corpuscles. The distinction between the two tumors is readily made with the naked eye, by the color of the fluid which they contain, the watery or milky lymph contrasting strongly with the red blood of the blood angeiomata.

CHAPTER III.

TUMORS COMPOSED OF DEVELOPED CONNECTIVE TISSUE.

Lipomata—Steatomata—Fatty Tumors.—These tumors are either sessile, “continuous,” or pedunculated, and are probably the fairest example of homologous tumors. They grow from either superficial or deep-seated fat and are found wherever adipose tissue is developed in the body. They may be, first, subcutaneous; second, subserous; third, sub-synovial; fourth, submucous; fifth, intermuscular; sixth, intramuscular; seventh, parosteal; eighth, meningeal.* They may occur at any period of life and remain for a considerable time without growing until from sudden appreciable or inappreciable cause they increase rapidly in size. They are not dangerous except in so far as the pressure symptoms are concerned, and do not return after extirpation.

When the fatty tumor is sessile or pedunculated it is encapsuled; when it is continuous or appears as an outgrowth it is not as a rule encapsuled. The author has only seen this latter variety on the nape of the neck; it appears like an agglomeration of fat corpuscles from the size of a small pea to that of a bean, held loosely together with a delicate connective tissue and bound down by fascia. On the shoulders, arms and legs, however, the masses of fat are quite large and lobulated, and held in position by a distinct though quite fragile capsule.

In the early stages of growth this capsule is thin and delicate; at a later period it becomes dense and hard. This fibrous degeneration of the capsule constitutes the variety described by Rokitansky, Gluge and Vogel as “steatoma,”† and “lardaceous tumor,” and by Müller as “lipoma mixtum.” Müller also distinguishes another variety, “cholesteatoma,” which is “apparently composed of crystalline fat inclosed in meshes of cellular tissue.”‡

In the diagnosis of this form of tumor the surgeon must first bear in mind that there may be, indeed there often is, a deceptive appearance of fluctuation, and this is more especially the case when the growth is pedunculated; it must also be remembered that there is a peculiar tendency in this form of tumor to drop down or shift its position, which fact will assist in the diagnosis. Although as a rule it is not difficult to recognize this peculiar growth, yet sometimes other tumors so nearly simulate it that care is necessary to arrive at a correct diagnosis. A fatty tumor which weighed after its removal twelve and a half pounds was mistaken for a spina bifida; the growth was situated midway in the lumbar region, and had been present since infancy.

A fatty tumor situated directly in the course of the great vessels may receive pulsation from the artery beneath; this has occurred in the

*Tumors, Innocent and Malignant. Sutton.

†The term “steatoma” is applied by some authors to encysted tumors.

‡Erichsen.

author's practice several times, once in the neck over the subclavian, and once in the inner side of the right thigh over the femoral (Plate XXXV). The pulsation was so distinct in both cases that careful examination only revealed the true nature of the growth. Drawing the growth away from the parts beneath is generally sufficient to arrest the pulsation. Plate XXXV represents a large pendulous lipoma of the thigh. In this there was distinct pulsation.

REMOVAL. To remove the flat continuous growths a single incision across the tumor, extending a little beyond its base, is generally sufficient; but if the growth is large, it may be necessary to make the cut either T, X or H shaped, then the dissection must be carefully continued around and beneath until the whole is removed. In the encapsuled variety the single incision (being sure that it is made down to the capsule) is sufficient. The handle of the scalpel and the fingers will generally be sufficient to dislodge the lobes, which often slip out in a most approved and cleanly fashion.

MICROSCOPIC APPEARANCES. Microscopically, the lipoma is composed of large fields of fat cells (Plate XXX, Fig. 7) traversed by slender trabeculae of fibrous tissue, bearing blood vessels. The trabeculae are offshoots from the fibrous capsule which encloses the lipoma. The nuclei of the fat cells are seen as purple dots crowded over to one side of the cell. Scattered here and there may be seen clusters of small round cells, which are young connective tissue corpuscles as yet undistended with fat. Higher magnifying powers (400-500) reveal triangular corpuscles with branching processes, like myxoma corpuscles, lying in the space left between three adjoining fat cells. If the specimen has not been exposed to the action of ether many of the fat cells will be found to contain rosettes of delicate yellowish needles. These are crystals of margaric or of the fatty acids.



Fig. 781.
Fibroma of Buttocks.
(Trowbridge.)

Fibromata.—(Fig. 781). These tumors, called desmoid tumors, possess all the characteristics of innocent growths; indeed, in many cases the body appears to tolerate this variety of tumor better than any other, immense fibroids of the uterus being carried with but little inconvenience excepting their weight for many years. There are three varieties: First, simple; second, molluscum fibrosum; third, neurofibroma; the last two may exist together, the latter having been already described under neuroma.

A fibroid is spherical or ovoid in shape, unless peculiarities of position or pressure alter this condition. To the touch fibromata are hard, (fibroma durum) elastic and firm, unless inflammation attacks them, when, of course, the tissues soften; at times a profuse hemorrhage results and

from the opening a fungoid growth may appear. This must be remembered in making a diagnosis between fibroma and vegetating epithelioma.

A fibrous tumor grows without pain and can be handled with impunity; indeed, the author has on several occasions removed tolerably large (six inches in circumference) fibroid polypi from the uterus, the patient making little complaint of pain, and not being under anesthetic influence. These growths, again, may be sessile or pedunculated, the latter receiving the name of "polypi." As a rule, also, the integument over them is found movable, unless inflammatory action be present.

Very often the fasciculi of a fibroma separate, and larger or smaller cysts develop within the structure; the tumor then receives the name "fibro-cystic," and if calcareous matter has been deposited, "fibro-calcareous." A completely calcified uterus is very rare. Fig. 783 represents one from the author's collection. The tumors are invested with a capsule, which however, is generally quite thin and requires care in its dissection, though this is not always the case. In one or two instances the author has found quite a distinct and firm capsule, and this he has noted more particularly in fibromata which were becoming cystic.

The uterus is most frequently affected with fibroma; the jaws come next in order, and after this, perhaps, the nerves, making the neuromatous tumor. These growths also attack the subcutaneous tissue, the breast, the lobes of the ears, and the bones. The fibroid tumor as it grows from the jaws receives the name of epulis. This tumor is hard, but not to such a degree as the ordinary fibroid;

it springs from the alveoli, and is connected distinctly with the periosteum; the tumor can be handled without pain, and often, nay, generally, is pedunculated. When it is raised with the forceps it sometimes looks serrated along its edges and is covered with mucous

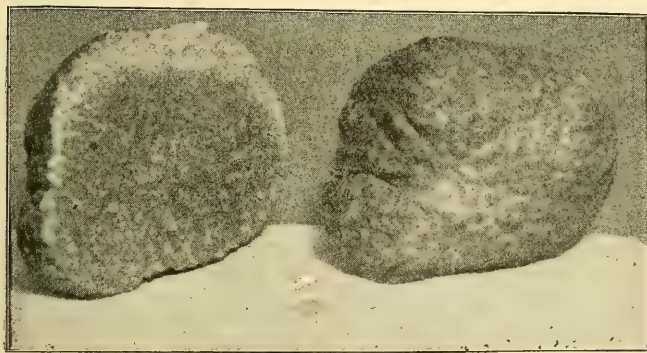


Fig. 783.

Myo-Fibroma Completely Calcified.—(A Stone Uterus.)—Helmuth.

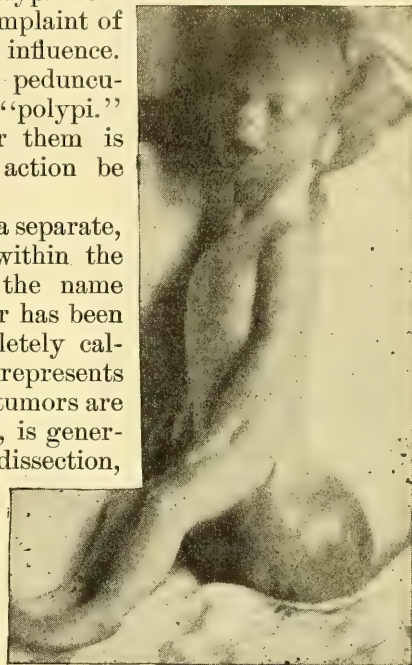


Fig. 782.

Fibroma of Buttocks.—Trowbridge.

membrane; absence of disease in the subjacent glands, and also of the tendency to infiltration or to cachexia, diagnoses it from malignant formations.

As a rule, time is lost in prescribing medicines for these tumors. The knife is the only resort.

MICROSCOPIC APPEARANCES. Microscopically, fibromata (Plate XXX, Fig. 2) are composed of delicate, curly, hair-like fibres which take a rose-red stain from eosin, seldom assuming the deep red color of smooth muscle fibre; however, thick sections of fibrous tissue and very thin sections of smooth muscle fibre may have the same tint. The fibrous bundles may be arranged, as in the upper part of the picture, in dense wavy bands, or they may be more loosely interwoven and tangled. The appearance of fibrous tissue under low magnifying powers (50-100) is shown in the angioma on the same plate, and in many of the epithelial tumors on Plates XXXI and XXXIII. Here the connective tissue corpuscles appear as purple streaks or dots lying among the fibrous bundles. With higher powers (Plate XXX, Fig. 2), the spindle shape of the corpuscles is well seen. Many of the corpuscles are curved and twisted, and they appear to lie upon the fibrous bundles rather than within them.

In old or hard fibromata (*fibroma durum*) the corpuscles are usually scanty. With hematoxylin and eosin staining the histologist not infrequently sees broad areas of level, red, apparently structureless substance, which is puzzling to the beginner. This is simply dense fibrous connective tissue, as may be demonstrated by examining the edge of the section, especially if the edge is ragged. On the other hand, rapidly growing or soft fibromata (*fibroma molle*) contain an abundance of spindle-form corpuscles, and many small round cells which are young connective tissue corpuscles, an appearance which may closely resemble that of fibrosarcoma; in fact, the two tumors may be indistinguishable in their microscopic appearances. In this case the diagnosis must depend upon the clinical history.

If the tumor is very edematous, as is frequently the case in pedunculated growths, especially *molluscum fibrosum*, the fibres become widely separated and the corpuscles are more distinctly seen. The tumor in this condition may resemble myxoma.

MOLLUSCUM FIBROSUM. This peculiar outgrowth of the skin and subcutaneous tissue has received the name of dermatolysis and pachydermatocele. These tumors may be small or large, from the size of a pea to immense pendulous masses. The interesting case represented in Plate XXXVI was seen in the Red Cross Hospital at Tokio, Japan, and is even more remarkable than those of Mott or Lamprey. Very often neuromatous tumors are associated with *molluscum fibrosum*.

KELOID. It was formerly supposed that true keloid formation arose outside of cicatrical tissue but modern microscopic research has abundantly proved that these peculiar fibroid growths always develop from a scar. The color of keloid resembles somewhat in appearance hyaline cartilage; it is smooth, elastic, shining; or, if there should be a number of dilated blood vessels it may become pinkish in color. It often happens that this tumor, although developing from scar tissue, does not confine itself to the cicatrix from which it grows, but spreads into the surrounding structures. The scars from burns, from the lashes of a whip, from puncturing the ears, from stitch-holes, frequently develop keloid. These tumors are harmless. They may grow slowly for years and then disappear without leaving a trace.



1. Small Round Cell Sarcoma of Thymus x 300.



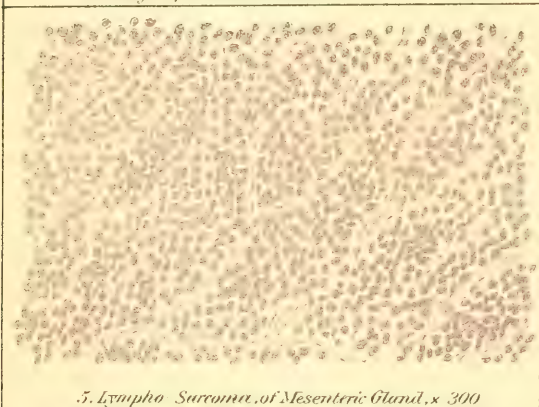
2. Small Spindle Cell Sarcoma of Skin x 200.



3. Large Spindle Cell Sarcoma of Skin x 300.



4. Large Round Cell Sarcoma of Femur x 500.



5. Lympho Sarcoma of Mesenteric Gland, x 300



6. Melanotic (Small Round Cell) Sarcoma of Eye Ball x 500



7. Giant Cell (Myeloid) Sarcoma of Upper Jaw x 300



8. Mixed Cell Sarcoma of Femur x 300.

Laidlaw.

PLATE XXXII

SARCOMATA.

HARDENED IN ALCOHOL. STAINED WITH HAEMATOXYLIN AND EOSIN AND MOUNTED IN CANADA BALSAM.

Blood vessels are present in varying numbers; the more dense the tumor, the fewer the vessels. There are no elastic fibres in the growth.

Myxomata.—Mucous tumors, known as fibro-cellular tumors, are in common medical nomenclature considered as “soft polypi” and that is their best name; nevertheless, they have received many others. According to Rokitsansky, a fibro-cellular tumor is “a gelatinous sarcoma;” according to Voight, it is “a connective tissue tumor;” according to Müller, it is “a cellulo-fibrous growth,” and according to Virchow, it is “a myxoma,” one of the endless varieties of sarcoma. These tumors are composed, as their name well indicates, of fasciculi of fibro-cellular structure, which are loose or otherwise, in accordance with the softness or succulency of the growth; in the meshes of this tissue is a fluid resembling somewhat the synovial.



Fig. 784. Nasal Myxoma.—Helmuth.

Myxomatous tumors have a soft and pulpy feel, are painless and grow with rapidity and may attain such considerable magnitude that parts may be displaced by them; they are generally continuous, are often lobulated, vide Fig. 784, and are pedunculated, hence the term “polypi.” They are chiefly found in the nose, ear and uterus. They also may arise from the connective tissue of other organs, especially the mammæ, and sometimes they exist in the skin, when they generally become papillary. This variety of neoplasm is probably the same as that spoken of by Paget as the true fibro-cellular tumors, which are found in “the scrotum, the labium, or the tissues by the side of the vagina, and the deep-seated intermuscular spaces in the thighs and arms.” Polypi present “opaque white bands intersecting a shining, succulent basis substance of serous-yellow or greenish-yellow tint; the whole mass closely resembles ‘anasarcous cellular tissue.’”

SECONDARY CHANGES. These tumors vary in the color, consistence, and nature of their contents; they are also subject to cartilaginous and ossific degeneration, and in some cases may ulcerate and slough.

TREATMENT. These morbid growths, however, sometimes yield to remedies. Dunham reports cases cured with *calcareo carbonica*, *teucrium* and *staphisagria*. The author has also seen excellent results from the injection of acetic acid, pure, four or five minims, directly into the tumor. The injection may be repeated once a week. Pattison has used successfully a snuff of powdered root of *sanguinaria canadensis*. Polypi may sometimes be cured by puncture and evacuation of the tumor. The author has very often succeeded in diminishing the size of polypi, and in one or two instances in curing them, with *calcareo carbonica* and *teucrium*, but has most frequently been obliged to resort to operative measures.

SPECIAL VARIETIES. There are other soft and succulent tumors which have been described, but which are all of the same character, and according to Virchow consist of “the embryonic tissue or Whartonian jelly of the cord.”

The *cylindromata* of Billroth are those in which “are found cylindrical structures of a clear and transparent appearance, arranged like a series of anastomosing branches, which terminate often in bulbous ends,

and contain numerous spindle or round cells, though they appear clear and structureless." At other times little flask-like bodies are discovered which are supposed to be some peculiar modification of the rudimental connective tissue. These tumors are sometimes classed as the semi-malignant, but there is not much actually known of them.

MICROSCOPIC APPEARANCE. The structure of myxoma (Plate XXX, Fig. 1) is that of embryonic tissue. There is a jelly-like, mucin-yielding basis substance which stains light blue or violet with hematoxylin, the color remaining unchanged by subsequent immersion in eosin. This basis substance may be watery or of semi-solid consistency. Microscopically it appears hyaline, granular or delicately fibrillated. Embedded in the basis substance is a coarse net-work which is fibro-granular in appearance. At the intersections of the net-work are found the characteristic myxoma corpuscles, which are bluish-black in color, triangular in shape, each arm of the triangle being prolonged as a delicate branch which reaches out along the net-work and blends with a projection from an adjoining corpuscle. Myxoma corpuscles also appear as slender spindles, which have similar processes reaching out before and behind them. Scattered through the tissue is a variable number of small round nucleated cells and bodies which are apparently free nuclei, all of which take the hematoxylin stain very deeply. As this tumor usually grows in the form of a submucous polyp, its surface will exhibit the structure of the mucous membrane which covers it; though stratified epithelia commonly develop on the exposed parts of a polypus (Sutton).

Enchondromata.—This is but another name for cartilaginous tumors, and is also synonymous with osteo-chondromata, chondromata and benign osteo-sarcomata of some authors. The author believes the simple expression "cartilaginous tumor" is preferable to any of these ambiguous terms.

It must be remembered that these tumors, though classed as innocent, occasionally recur after their removal, although in most cases their reappearance is owing to admixture of imperfectly developed cells.

These tumors present many peculiarities, among which may be noticed the difference in structure which is presented in a single enlargement. Paget* gives an accurate description of enchondromata: "To the touch, cartilaginous tumors may be very firm or hard, especially when they are not nodular and their bases are ossified. In other cases they are firm, though compressible and extremely elastic, feeling like thick-walled, tensely-filled sacs. Many a solid cartilaginous tumor has been punctured in the expectation that it would prove to be a cyst."

In the specimens in the author's possession the different physical properties as to touch and eye are appreciable. The bases of the excrescences are particularly cartilaginous, while the superficial parts are much more elastic, and this difference is to a greater degree apparent immediately after an operation than after the immersion of the tumor in spirits. In enchondroma all the intermediate gradations, from the hardest cartilage to the softest consistency of ordinary fatty tumors, are present, and necessarily the microscopic characters of each of these different portions present a different cell formation.

Rokitansky wrote long since that "wounds of cartilage are not reunited

*Surgical Pathology, p. 422.

by means of cartilaginous substance, nor is this substance regenerated when destroyed. Nevertheless, new growths of cartilaginous texture are both frequent and voluminous. The structure of the growths or tumors was first ascertained with the aid of the microscope by Johannes Müller, who applied to them the term 'enchondroma.' These excepted, not a single new growth whether designated as cartilage-like or as cartilaginous, chondroid, or fibro-chondroid, has more than a seeming analogy with true cartilage texture." These growths have occasional place upon the lower jaw, but the general site is upon the fingers or thighs.

Cartilaginous tumors are subject to degenerative liquefaction, which may occur either on the periphery or in the interior. The central softening often proceeds to the formation of cysts, the skin covering the tumor inflames, ulcerates and sloughs; fistulous openings form, and a viscid, ichorous fluid is discharged. It is a somewhat singular fact that these two processes—ossification and disintegration—may coexist in different parts of the same tumor. Calcareous and fatty degeneration may also occur.

Pattison reports that he has successfully enucleated an enchondroma of the index finger with a saturated solution of sulphate of zinc.

The usual and best surgical treatment is excision of the tumor, or amputation of the affected part.

MICROSCOPIC APPEARANCES. Microscopically, enchondromata are usually composed of masses of hyaline cartilage, separated by narrow septa of fibrous connective tissue, which are continuous with a connective tissue capsule. Plate XXX, Fig. 3, was drawn from a section of such a growth. To the left is cartilage basis substance, stained red with eosin and containing bluish cartilage corpuscles, which in this case resemble those of normal cartilage in their plumpness and aggregation in threes and fours. Where the cartilage adjoins the fibrous septum the corpuscles become spindle-shaped, fibres appear, and the cartilaginous basis substance merges gradually into the fibrous form. The cells

of enchondromata vary greatly in shape, size and abundance. Sometimes there are large branching corpuscles like myxoma corpuscles, or the cells found in the margin of articular cartilage. A mixture of enchondroma and myxoma is not infrequent. In other cases the tumor is composed of true fibro-cartilage; that is, of cartilage corpuscles lying in a cartilaginous basis substance that is delicately fibrillated.

Osteomata.—As has been already noticed, ossific deposit may be found in cartilaginous and other tumors, but growths undergoing such change do not receive the name osteoma, it being applied to fully-developed bony formations. Osseous tumors are homologous, or, in other words, innocent, their resemblance to healthy bone formation of the body being perfect, both anatomically and chemically.

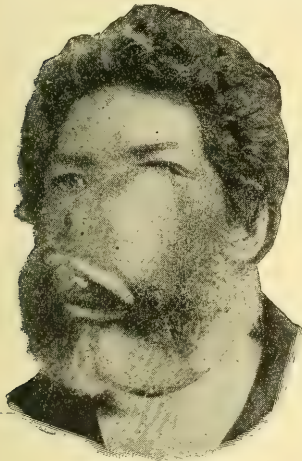


Fig. 785.
Eburnated Exostosis of the
Upper Jaw.—Helmuth.

These tumors are generally outgrowths, and partake either of the nature of the compact or cancellated structure. In the compact or ivory

or eburnated exostoses (Fig. 785), which chiefly are found connected with the cranial bones, the structure is firm and of different shapes. These tumors are attached either within or without the cranium, and when in the latter position are very difficult to diagnose. "This exostosis," says Rindfleisch, "is so remarkable a phenomenon just because quite divergent from the usual schema, namely, without regard to the vessels and their course the osseous tissue is deposited layer by layer about one of the smallest tubers as a nucleus. This gradually becomes a warty, polypus-like, white formation, which may attain the size of a man's fist and nevertheless consist throughout of compact bony structure. This entire kind of growth undoubtedly reminds us of dentine."*

It is worthy of remark, also, that there often exists between the compact layers of bone a cancellated structure, and that in very many cases the tumors have a small base, are round, smooth, and hard, and sometimes rise to a considerable height above the surrounding bones. The pain they occasion is generally that of pressure.

The second variety or cancellated exostosis, as the name indicates, is formed of structure exactly resembling the cancellated structure of healthy bone. They usually arise from cartilaginous tumors, are round, lobulated, sometimes presenting spiculæ or angles. These tumors grow in most peculiar locations, and Paget calls especial attention to those found at the lower end of the femur, above the insertion of the adductor magnus.†

These tumors grow often by stems or peduncles, which when broken do not appear to be reproduced. A peculiarly hard species of this variety is that growing from the last phalanx of the great toe, giving severe pain, pushing up the nail, and rendering the parts around sensitive. The author has removed many of these subungual exostoses, and found them hard, unyielding, perfectly cancellated, and being direct out-growths from the last phalanx of the toe. Sometimes these tumors grow from the little toe, and also from the dorsal surface of the last phalanx.

The upper jaw is often affected with exostosis, and in some cases there appears to be a hereditary tendency to the production of these tumors.

The medical management of osteoma will be found in the chapters upon diseases of the bones, and in other parts of the volume treating on the surgery of those regions where they most frequently appear. Suffice it here to say that some very remarkable cures have been made. In most instances, however, removal of the parts is necessary.

MICROSCOPIC APPEARANCES. Two varieties: a, compact; b, cancellated or spongy osteoma.

The minute structure of compact osteoma is similar to that of normal compact bone, or rather to the cortical layer of the bone. The lamellæ run parallel to the surface of the tumor. As represented on Plate XXX, Fig. 5, they enclose many characteristic lacunæ and bone corpuscles. Haversian canals, when present, are few in number and irregularly arranged. They resemble the arrangement of external callos in that they run perpendicular to the long axis of the bone in which the tumor grows. The tumor is covered by a fibrous periosteum. A

*Textbook of Pathological Histology, p. 602.

†Surgical Pathology, p. 532.

variety of compact osteoma grows in the bones of the skull in syphilitic subjects. It has no Haversian canals, but is composed of a series of concentric lamellæ arranged parallel to the surface of the growth. It is called eburnated osteoma.

Spongy or soft osteoma resembles the structure of cancellous bone. The irregular trabeculæ, which are stained red, contain numerous bluish bone corpuscles. The bony trabeculæ are separated by narrow spaces, which contain a variable number of broad spindle and round cells, with delicate fibres and blood vessels. Spongy osteomata, containing well-developed marrow spaces, are classed by Virchow as osteoma myeloides. The tumor is usually covered by a thin layer of cartilage or of compact bone.

Lymphomata—Lymphoma—Lympho-Sarcoma.—These are terms used to designate a peculiar hypertrophy of the lymphatic glands, which has been so accurately described by Hodgkin* that it is now named "Hodgkin's disease." Wilks calls the disease lymphatic anemia, Cassey, general hypertrophy of the lymphatic glands, and Wunderlich, multiple lymphadenoma. The cervical glands are those most generally affected, but the axillary are also not infrequently attacked, as may be other of the glandular tissues. The disease does not depend on zymotic influences and bears in many respects a resemblance to phthisis. In some cases it may be caused by traumatism. The glands gradually enlarge, with their connective tissue, and these appearances may result from a bruise or a strain, or may appear without any appreciable cause. A small swelling may be the first indication of the disease. Acute pain, neuralgic in its character, accompanies the growth, or may appear in the locality before the tumor is noticed. The neoplasm is at first movable, but it grows rapidly without seriously inconveniencing the patient. A peculiar and frequent accompaniment of the disease is leucocythemia, the white blood-corpuscles being always in excess, and often in enormous quantities. There is also the usual *bruit de souffle* which accompanies the condition. A single gland may be thus affected, or, as is more frequently the case, several become seats of the disorder, and finally tumors in the lungs, liver and cellular tissue are developed. Lymphadenoma is not always accompanied by leucocythemia, as is noted by Haward, and offers a better opportunity for treatment when uncomplicated. Jaccoud concludes that this disease is occasioned by a two-fold condition of the blood; in the one the red globules are much reduced; in the other this condition coexists with a vast increase in the leucocytes; according to this view the anatomical constitution is different in each variety. He is of opinion that in the latter cases, viz., where there is a great increase in the amount of the white blood corpuscles, the new growth is altogether expended in the cellular elements, but when both conditions noted above are combined the capsule of the glands and the connective tissue are much thickened. At present operative interference is scarcely considered justifiable, as most of the cases reported have proved fatal.

It is held that there are forms of lymphadenoma which are malignant, and others which are not, but the definite histological criteria for determining between the two varieties are not pointed out. The conclusion

* Medico-Chirurgical Transactions, 1832.

drawn from these cases is that the removal of these tumors is not advisable when there is any suspicion of visceral implication.

There are certain indications for treatment in lymphadenoma which should be remembered. The author has had several cases of the disease and has observed the course generally taken by the enlarged glands—often tending to suppuration and always obstinate to treat. The medicines are mercury, baryta carbonica, calcarea, conium, arsenicum and the iodide of potassium.

During the past six months, the author's attention having been called to the use of the varied animal extracts, and having on his hands three cases of lymphadenoma, it was resolved to try the use of the thyroid extract in the treatment. The extract in powder was first administered, but it became so offensive that the patients could not employ it. The tablets made by Burroughs and Wellcome, of London, were then procured, each containing five grains, and given one each night, gradually diminishing the doses and lengthening the interval between them. Every one of these cases were materially benefited, one certainly cured, by this method; and the treatment is mentioned in this place with the hope that others may be induced to employ it in this rather intractable disorder.

To the enlarged glands the author applies the mineral earth, as prepared by the Baltimore Company, made into a paste. This is put on every night and retained in position by an appropriate bandage. The author has perhaps the most satisfactory results from the prolonged use of calcarea and arsenic, giving the former in the 2x trituration, three grains night and morning for a week, and a drop of the tincture of arsenic, night and morning, after meals, for the succeeding week, continuing this treatment for several months. As the glands soften suppuration comes on and mercury and calcium sulphide are given, and if these means, after being persistently tried, fail, extirpation of the glands, if practicable, can be practiced.

For the microscopic appearances, refer to the subsequent article on lympho-sarcoma.

There is a rare form of lingual lymphangioma in which the tongue becomes enormously enlarged, especially at its anterior portion. This disease receives the name of macroglossia, and the enlargement is not due, according to Virchow, to an increase in the muscular or fibrous tissue as was formerly supposed, but to the formation of a lymphangioma in connection with the lingual mucous membrane. Fig. 786 represents a rare case of this disease.



Fig. 786.
Macroglossia.—Lingual Lymphangioma.—Helmuth.

CHAPTER IV.
INNOCENT TUMORS (HOMOLOGOUS.)
EPITHELIAL TISSUE.

Typical Nomenclature.—Types of fully developed epithelial tissue are: Mucous membrane and skin, papillomata, horny tumors; glandular, adenomata.

Papillomata.—By those familiar with the histological formation of the skin and mucous membrane the appearances and structure of papillomata will readily be understood. These growths have always some connective tissue mingled with the epithelial elements, and are divided into two classes: First. The hard or horny papillomata, in which there is a preponderance of connective tissue, and which grow upon the skin, embracing warts, horny growths and nail tissue; and, second, those in which epithelia are very numerous, embracing soft outgrowths which spring from the mucous membranes of the mouth, the larynx, the rectum, the bladder, and sometimes from the uterus. The so-called “painful caruncle” of the female urethra comes also under this classification.

The soft or myxomatous papillomata are well supplied with blood vessels and bleed readily, while the former are not vascular. The color often noticed in the hard growth is derived from pigment deposited in the deepest layer of the epithelia.

Often in the myxomatous papilloma shreds and bits of membrane are cast off with the natural secretions of the part.

It is stated by some authorities that from constant irritation of these growths they may develop a myeloid or round-celled formation, which theory, from recent observations, the author is disposed to accept.

HORNY TUMORS. These curious morbid growths generally occur in connection with sebaceous follicles, and their origin can frequently be traced to injuries or chronic inflammation. (Vide Fig. 787.)



Fig. 787. Horny Tumor of Lip.—(Helmuth.)

They are usually found about the head and face, but may also exist in other parts of the body. They first appear as soft, semi-transparent masses enclosed in complete cysts; as they increase in size they become dense and hard, and assume all the characteristics of horny structure. They grow slowly, but frequently attain considerable magnitude; one case has been reported in which the tumor measured eleven inches in length by two and one-half inches in circumference, and in another instance the horn was fourteen inches around the base. They are more or less flexible, and of an almost cartilaginous hardness. The surface is marked by rough rings, indicating the different stages of growth; sometimes it is knotted or covered with small pearl-like scales. In shape they

are usually conical, and twisted upon themselves like the horns of a sheep; their color varies from a dingy yellow to brown or black.

The only treatment for these tumors is excision

MICROSCOPIC APPEARANCES. Papilloma is essentially a fibroma or myxoma of peculiar shape, which first appears in the connective tissue that lies beneath an epithelial surface. As represented in Plate XXXI, Fig. 10, there is a main body of pink fibrous (or myxomatous) tissue, from which slender, branching arms or papillæ shoot upward, pushing the pre-existing epithelial covering before them. The pink fibrous bundles are dotted with the small purple nuclei of the connective tissue corpuscles, and sections of endothelia-lined capillaries are numerous. This low power view shows that the epithelia maintain their normal divisions into rete Malpighii and stratum corneum; while a higher power (300-500) would demonstrate that the lowest layer of the epithelia, that adjoining the papillæ, is composed of columnar cells, surmounted by many layers of cuboidal, and these again by strata of squamous, epithelia; thus preserving, in every respect, the arrangement of stratified epithelium of the normal skin.

In the case of a papilloma of a glandular mucous membrane, like the intestinal mucosa, Plate XXXI, Fig. 11, there is observed a similar central core and similar branching papillæ of fibrous tissue; but the epithelial covering in this case takes the form of closely set tubular glands, apparently a reduplication of the follicles of Lieberkühn.

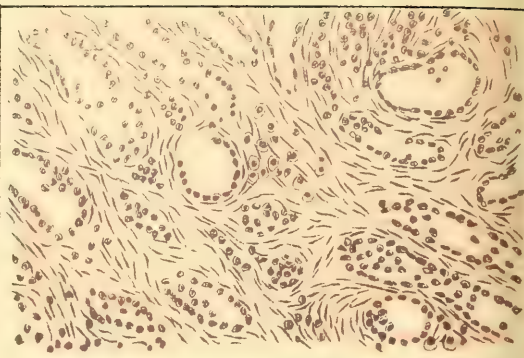
In the growth of these tumors as the papillæ shoot upward they push before them the epithelial investment which is composed of stratified or simple columnar epithelia or of gland tubules. This epithelial covering stretches before the advancing papillæ. In most papillomata the growth of the papillæ and the central core advances more than the simple elasticity of the skin or mucous membrane will permit. In the skin there must be a proliferation of the epithelia and the line of stratified epithelium is lengthened. In the intestinal mucous membrane new follicles of Lieberkühn are formed which lie side by side with the old ones. The new growth of the epithelia keeps pace with the advance of the fibrous papillæ and in this way the epithelial covering is lengthened out so that the papillæ are always covered by the normal epithelial investment of the part.

There is, however, a sharp distinction to be drawn between the new formation of epithelia in a papilloma and that which occurs in an adenoma or a cancer. Adenomata and carcinomata are closely allied in their clinical history as well as in their microscopic structure. Papilloma is to be sharply separated from them as an innocent tumor, and there is also a marked difference between the growth of a papilloma on the one hand and that of an adenoma or a carcinoma on the other hand, in that in adenomata and cancers the epithelial overgrowth is the first and most important factor. Any new formation of fibrous tissue which occurs in them is secondary to the advance of the epithelial cells; whereas, in papilloma the epithelial growth is entirely consecutive to and dependent upon the growth of the fibrous papillæ.

Papillomata of the bladder, or villous papillomata (Plate XX), present the usual structure of a central core, which is composed of fibrous or myxomatous tissue and is richly supplied with blood vessels. The



1. Adenoma of Breast $\times 75$



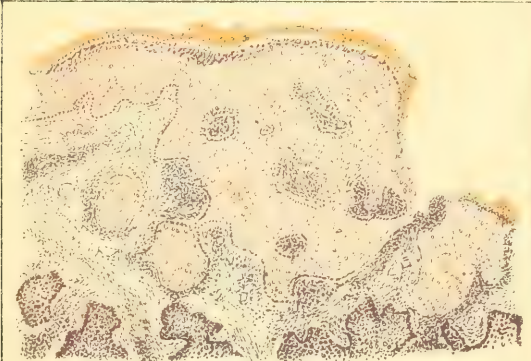
2. Malignant Adenoma (Carcinoma) of Epithelium of Breast $\times 200$



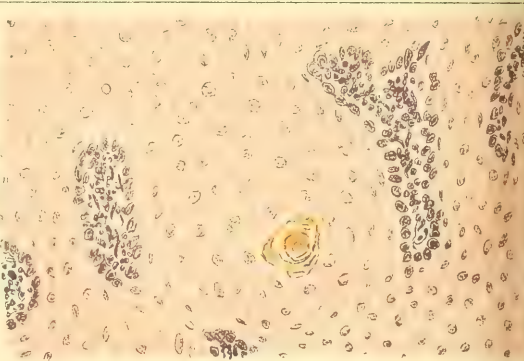
3. Carcinoma of Endometrium $\times 50$



4. Carcinoma of Endometrium $\times 50$



5. Epithelioma of Groin $\times 10$



6. Epithelioma of Groin $\times 100$



7. Alveolar Sarcoma of Orbit $\times 40$



8. Alveolar Sarcoma of Orbit $\times 300$

Laidlaw.

PLATE XXXIII

TUMORS

HARDENED IN ALCOHOL, STAINED WITH HAEMATOXYLIN AND EOSIN AND MOUNTED IN CANADA BALSAM

papillæ are often very long and slender, and are easily torn off. They are covered with a single or multiple layer of columnar or irregularly shaped epithelia.

Adenomata, or Glandular Tumors.—These tumors are most commonly found in the breast, in the prostate, in the thyroid gland, and sometimes in the lip, the name of the part in which they grow generally being added to determine their locality, thus: labial glandular tumor, mammary glandular tumor, etc. In the majority of cases the growths occur within the glands, but sometimes they are found external to them.

These tumors are more frequent in adult life; they grow slowly and may attain considerable size without much inconvenience; they are smooth, round, and sometimes lobulated. When they are cut into, their structure appears to be separated by interstices, in which a small quantity of fluid is found; they are, especially in the breast, encased in a distinct capsule, and generally may be dissected out with ease. They are painless, unless from pressure, or, as in the mammary gland, from dragging the parts downward. Occasionally cysts are developed in the substance of these tumors, which appear to contain a serous fluid resembling that spoken of above as found in the interstices of the tumor.

These tumors are amenable to treatment, and have been seen to disappear under *calcareæ carbonica*, conium, and especially phosphorus. In the breast they are likely to enlarge during the menstrual period. In operating they may be taken out by removing the capsule and enucleating the morbid mass. Sometimes, however, the gland must also be extirpated, especially when much of its substance is involved.

MICROSCOPIC APPEARANCES. These tumors consist of newly formed gland tubules, surrounded by more or less newly formed connective tissue.

On microscopic examination we distinguish four varieties of adenomata, a, tubular; b, acinous; c, cystic, and d, papillary adenomata.

(a). Plate XXXIII, Fig. 1, represents the so-called tubular adenoma of the breast. It shows a red stroma of fibrous tissue, in which the connective tissue corpuscles appear as minute purple dashes and dots. Embedded in the fibrous stroma are gland tubules, distinguished by an open lumen or central channel, lined with a row of black dots, from which a fringe projects into the lumen of the tubule. This red fringe consists of the bodies of the small columnar epithelia that line the tubule, each black dot representing the nucleus of an epithelium. The nucleus is situated at the base of the epithelium, that is, next to the fibrous tissue. The structure of the gland tubule is better seen in the larger glands of the endometrium (Fig. 3 on same Plate). In Fig. 1, there are seen, projecting into the tubules, groups of small bluish red cells, sometimes, but not often, nucleated. They may completely fill the tubule or acinus and are apt to be mistaken by the beginner for cancer nests. This appearance is of frequent occurrence in sections of all normal glands. In cutting the tissues the knife slants across the tubule and cuts through one row of cells, showing the nucleated portion. It also cuts off the tops of several rows of adjoining cells. It is this group of cell tops that gives the misleading appearance. The knife may cut through the nucleated portion of several rows, which gives the appearance of a tubule packed with nucleated cells.

The gland tubules of an adenoma do not communicate with those of the gland in which they grow. They often have the power of elaborating a secretion; but it does not resemble the juice secreted by the normal gland.

(b). The breast tumor may consist largely of acini similar to those of the normal gland, in which case the tumor is an acinous or alveolar adenoma.

(c). The adenoma often contains cysts of various sizes, which are formed by the distension of the tubules through accumulated secretion or infiltration. There are the cystic adenomata or adenocoeles. Microscopically, the cysts appear as rounded open spaces in the fibrous tissue, lined with a single layer of columnar epithelia; though, in some cases, the epithelia have disintegrated and disappeared. Sometimes the section will exhibit the point where a tubule opens into a cyst.

(d). In cystic adenomata the fibrous stroma may grow up into the cyst in the form of branching papillæ that are still covered by the columnar epithelia which formerly lined the cyst wall. These tumors form the papillary adenomata, papillo-cystomata or papillary cysts.

Ovarian cysts present a similar structure. They are held to be adenomata, which begin as newly-formed Graafian follicles, lined by columnar or cuboidal epithelia. These become distended with mucoid or colloid material, which stains pink with eosin. The smaller cysts break into one another and the resulting cavity may become distended to an enormous size. Sometimes the epithelial lining is present, but more frequently it has disintegrated when the tumor comes under examination. The cyst wall consists of the usual ovarian fibro-muscular tissue, in which are found great numbers of small round cells. Papillary cysts of the ovary are similar to the tumors of the same name that occur in the breast.

Adenomata of the sebaceous and sweat glands are rather hyperplasiæ than new growths. They are uniform enlargements of the pre-existing glands. (Green.)

There is a sessile, tumor-like mass which grows from the endometrium, especially from the cervix, and projects into the vagina. Structurally, as represented on Plate XXXIII, Fig. 3, it is composed of gland tubules and a delicate fibrous stroma which is thickly studded with round cells, resembling in all respects the normal endometrium. It partakes of the nature of a hyperplasia in the close similarity of the newly formed gland tubules to the old, and in the evident power of the new tubules to manufacture a mucous secretion similar to that of the pre-existing glands. On account of the abundant new formation of gland tubules, however, this growth is usually termed adenomatous hyperplasia. In itself it is benign, but sometimes becomes converted into an epithelioma.

In examining curettings from the uterus it is often difficult to distinguish between this benign adenomatous hyperplasia and malignant adenoma (columnar-celled epithelioma) of the endometrium. In the benign growth the epithelia which line the tubules are arranged in a regular manner and the tubule closely simulates the normal structure. In malignant adenoma, as in the similar growth of the rectum, drawn in Fig. 2 of the same plate, the epithelial lining of the tubules is imperfect, either

incomplete or excessive. Many of the epithelia have escaped from the tubule and are seen lying free in the interstitial connective tissue.

The so-called papillo-adenomata or pedunculated adenomata (Sutton) of the rectum and uterus are regarded by the author as true papillomata, for the description of which the reader is referred to the paragraph on papilloma. "Malignant adenoma" or adenoid cancer is described under epithelioma.

CHAPTER V. SARCOMA AND CARCINOMA.

Distinction.—The subject of carcinoma and sarcoma, taken collectively, would, in the light of present scientific discovery, cover an endless field. In fact, it would be impossible to collect and refer to the varied essays, investigations and experiments which have been made regarding the true pathology of these tumors and their varieties. Until the last quarter of a century the true distinction between sarcoma and carcinoma was unknown. The term sarcoma meant a fleshy tumor situated in any part of the body,* and was applied to that variety of myo-fibroma in which the blood vessels were numerous, and which contained a certain amount of unstriped muscular fibre. When Abernethy attempted his classification he arranged most of the innocent growths under the term

sarcoma, excepting the cystic and bony tumors, and it is probable that what we now term sarcomata were grouped under the head of cancer.

As has already been explained, a sarcoma is a new growth consisting of embryonic connective tissue. It does not progress to more normal development, but has a constant tendency to retrograde - metamorphosis. The blood vessels run between the cells and the cells multiply by division.



Fig. 788. Carcinoma of Jaw—Cook County Hospital Case.
Base of Tongue Exposed.

A carcinoma is an epithelial growth of embryonic cells, the arrangement and peculiar massing together of which, rather than the actual shapes of the cell element, are characteristic. It rapidly infiltrates and destroys tissue. The blood vessels anastomose in the walls of the alveoli, and cell-proliferation is rapid by endogenous multiplication.

In the classification of sarcomata into the different varieties it must be remembered that such tumors may present a myeloid appearance

*Sed si magni tumores oriuntur qui ut massæ carneæ supra reliquam cutem dependent sarcomata vocavi confueverunt.—*Heister, vol. I, p. 477, Institutiones Chirurgicæ.*
(1234)

(Paget) (giant-celled sarcoma) at one point, the manifestations of a recurrent fibroid condition (spindle cells) at another point, and round cells at another; and a still more important fact may be stated in that a truly benign growth may show typical innocent cells at one part of its substance, and truly atypical malignant cells at another. This seems to be almost a paradox, yet the author's experience, backed by the testimony of the most experienced professional microscopists, bears out the assertion.

These conclusions have been arrived at from the examination of the author's own specimens, tumors that he has removed himself and of which he has the clinical history, both before and after operation, which conditions are claimed to be of great import and entitled to some weight.

With all these differences it has been found necessary for a proper treatment of these growths to understand that those which infest certain tissues are materially different from those in other localities; that, for instance, a carcinoma, or a sarcoma of the testicle, has a different life-history and course from such growth in the larynx, and steps are now being taken by distinguished pathologists, here and abroad, to classify these growths, in order to arrange a scheme for their treatment, both medical and operative.

Another difficulty in the classification arises in the fact that certain pathologists declare that parts of a tumor may be sarcomatous and other portions carcinomatous. When this combination of atypical cell elements was first presented to the author's mind he could not quite understand why this could be the case, that is, if we acknowledged the epithelial origin of the one and the connective tissue origin of the other. An explanation has been attempted by Virchow (who has named these tumors sarcoma-carcinomatousum), in that the two varieties may develop at the same time from the different tissues; but the condition is one more of resemblance than identity and arises chiefly in the arrangement of the cells, in the one case (carcinoma) the stroma resembling a sarcoma, and in the other (sarcoma) with alveoli, resembling carcinoma. Both these tumors are atypical, neither resembling fully the developed tissues which are said to spring from either the epithelial or the connective tissues.



Fig. 783.
Sarcoma of the Antrum.
—Macdonald.

Such a mixed form of growth might be found in the upper jaw, for in the cavity of Highmore a complete mucous surface exists, from which true carcinoma may develop, while a sarcoma might arise from the bony connective tissue. This combination the author has seen in more than one instance. There are certain clinical signs by which these growths may in some cases be recognized before an operation is performed, but in the majority of cases the matter is guess-work. It is very difficult, and in some cases utterly impossible, for any surgeon to say what variety of sarcoma he has to deal with; indeed, in very many cases he cannot say whether he has a carcinoma or a sarcoma or a chondroma before him. An alveolar sarcoma and an encephaloid cancer in their first stages, a chondroma and

sarcoma, or an adenoma and a carcinoma, cannot be diagnosed the one from the other while they rest in the human body. It may be quite easy when the reports on the prepared section come from the microscopist, but the microscopist himself may be very much mistaken indeed—unless he has had sections given him from every portion of the tumor.

The endless diversity and confusion of such classifications tend only to confuse the student. Satiny, in one of the prominent periodicals, writes, "The tumor after extirpation proved to be a myo-chondro-adenosarcoma." *

A typical variety of sarcoma is very rare. In most of these tumors the cell elements are mixed and thus receive names which only add to the confusion of classification. The most pronounced varieties are the spindle-celled, the giant-celled and the round-celled; the most of the others are mixed. Thus the alveolar sarcoma is a round-celled growth with an alveolar structure resembling carcinoma. The terms lympho-sarcoma, myxo-sarcoma, angio-sarcoma, etc., are used to represent varied forms of the neoplasm. With the carcinomas there is more tendency to real typical classification, and we are more familiar with the squamous-celled carcinoma (epithelioma), the spheroidal-celled (scirrhus), when there is a quantity of interspersed fibrous tissue, and medullary or encephaloid, which contains a greater proportion of cells. Melanotic carcinoma and melanotic sarcoma are recognized by their pigment, and both are extremely fatal. It is difficult even for the microscopist to diagnose between them.

It would be very satisfactory if the surgeon when called upon to diagnose a tumor in its earlier stages could recognize a sarcoma from a carcinoma. The more precise classification may be reserved for further study and investigation. There are certain clinical signs which may assist in a correct appreciation of the character of a growth while it yet lies in the body, and be of service in regard to prognosis.

Clinical Appearances.—First. If the patient presents a smooth, somewhat elastic tumor of the bones (excepting those of the upper jaw) the growth will generally be found to be sarcomatous, either subperiosteal or central, because there is no epithelial structure found in the bone.

Second. When a tumor is firm, round and hard, growing with rapidity, easily movable and occasioned by traumatism, it is generally a sarcoma (of course setting aside inflammatory formations).

Third. When a tumor infiltrates the surrounding tissue early and extensively it is generally carcinomatous.

Fourth. When there are secondary glandular enlargements it is generally carcinomatous.

Fifth. When diffuse infiltration results the disease is carcinomatous.

Sixth. When a tumor grows rapidly, does not present the infiltration of carcinoma, and still shows some of the peculiar fungoid and bleeding formations of the old encephaloid cancer, the growth may be fairly designated a round-celled sarcoma.

Seventh. When a tumor grows from the jaw-bones and presents the appearance of marrow, does not bleed easily, resembling often in its earlier stages a true epulis, it may be considered a giant-celled sarcoma or myeloid tumor.

*Annals of Surgery, Sept., 1894.



Figure 1. Case of Red Fibroid Involving Entire Uterus.—Helmuth.

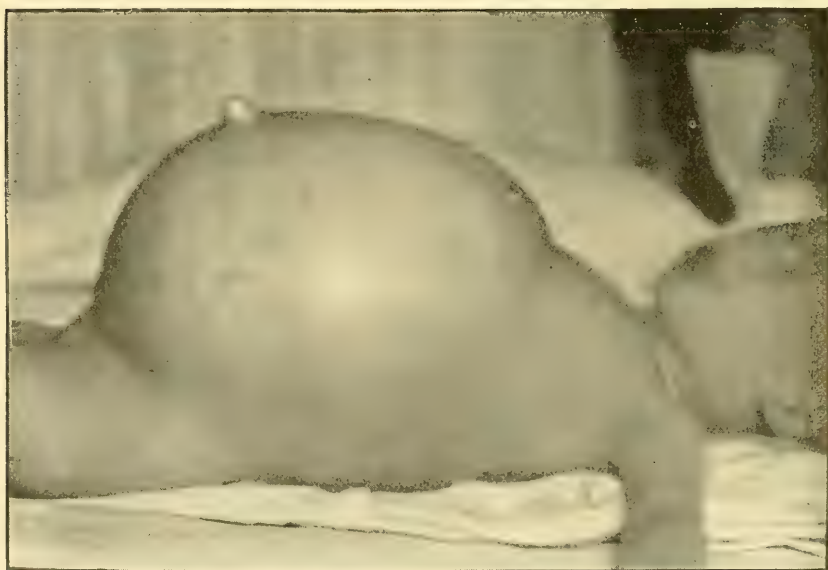


Figure 2. Sarcoma of Spleen in an Infant.—Helmuth.

PLATE XXXIV.

Eighth. When a tumor is hard but fibrous, growing in the neck or groin, is smooth and exists for some time with neither infiltration nor secondary deposits, it may be pronounced a recurrent fibroid, a spindle-celled sarcoma.

Ninth. When a tumor is hard, nodulated, with sharp, stinging pain, with a tendency to contract all the tissues in which it is embedded, and finally to ulcerate and to infiltrate, but without fungoid growth, it may be stated to be scirrhus cancer—spheroidal-celled carcinoma with much fibrous tissue.

Tenth. When a tumor is elastic, soft, with enlarged veins running over the surface, with early glandular enlargement and rapid infiltration with tendency to ulceration, from which a fungoid growth rises, with loss of strength, it is a soft or encephaloid cancer—a spheroidal-celled carcinoma with great quantities of atypical cells.

Eleventh. When a tumor springs from a crack, a wart or a small nodule in the mucous surfaces, presents to the naked eye a rough and strawberry-like appearance, with tendency to ulceration and bleeding when touched, an epithelioma—squamous-celled carcinoma—may be diagnosed.

Twelfth. When a tumor grows rapidly, bleeds upon the slightest touch, is purplish in color, composed of a friable and crumbling mass, irregular of outline and bluish in color, an angio-sarcoma may be diagnosed.



Fig. 790. Carcinoma of the Cecum.—Chislett.

Thirteenth. Cachexia belongs to carcinoma.

Fourteenth. When a tumor has existed a long time and still is circumscribed, and presents excavations without infiltration and no cachexia, it is sarcomatous.

Fifteenth. Pain is excessive in carcinoma, is bearable in sarcoma.

Sixteenth. The sarcoma is encapsuled, especially during its innocent period. A carcinoma is not.

Seventeenth. A tumor with a long, benign life is generally sarcomatous, and the author is persuaded that what in the olden times was designated as withering scirrhus was a true sarcoma existing in its benign form through life.

CHAPTER VI. THE SARCOMATA.

Types.—Spindle-celled sarcoma (recurrent fibroid.) Giant-celled sarcoma (myeloid.) Round-celled sarcoma (glioma.) Lympho-sarcoma. Alveolar sarcoma. Melano-sarcoma.

Spindle-Celled Sarcomata—Recurrent Fibroid Tumors.—The chief characteristics of the spindle-celled sarcoma appear to be as follows: First, their almost invariable tendency to recurrence after removal, such reappearance not being attributable to any portions of the tumor which may have been accidentally allowed to remain in the parts. Second, they generally appear at the site of the former wound, as well as in other portions of the body. Third, their growth is slow at first, but afterwards they enlarge with greater rapidity. Fourth, they give but little pain, and life is not threatened by them for a long time, unless (which most frequently happens) local pressure causes danger and death. Fifth, the superjacent skin is not involved, nor does it proceed to ulceration, unless such solution of continuity is produced by tension and consequent deficiency of circulation.

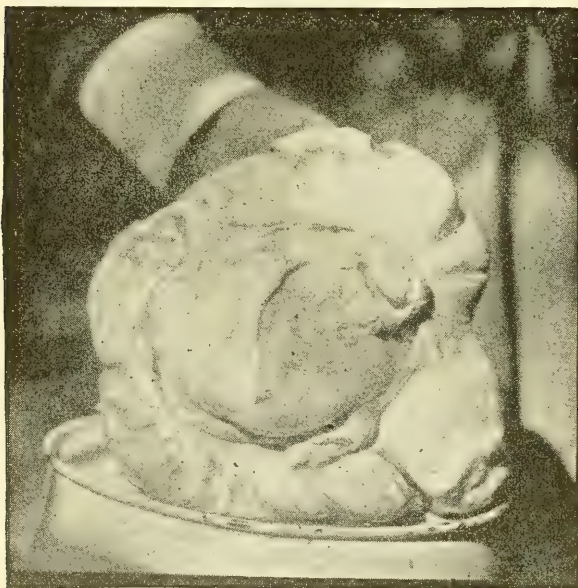


Fig. 791. Sarcoma of Spleen—Helmuth.

Sixth, they are hard, lobulated, and often immovable, appearing to be firmly attached to the aponeuroses and fibrous sheaths. Seventh, they do not infiltrate the tissues surrounding them, nor do they produce the cachexia found in cancers. Eighth, their structure appears to resemble somewhat the natural tissues of the body, but the cell-element is rudimentary, incomplete and preponderating. Ninth, the oftener they recur the more succulent and soft do they become, and the more rapid is

their growth. Tenth, the cells composing them are spindle-shaped and caudate, often with attenuated processes, with large nuclei. There may be, also, free nuclei scattered throughout the intermediate cellular substance. Eleventh, the hardness or softness of spindle-celled sarcoma con-



PENDULOUS FATTY TUMOR OF THIGH—DISTINCT
PULSATION—HELMUTH.

PLATE XXXV.

sists in the deposit of fatty particles in the one variety, and their absence in the other.

The secondary changes which take place in these tumors give rise to many difficulties in diagnosis. The most frequent is fatty degeneration, but there may be deposits of calcareous matter, and even pigmentation may occur—in the former case giving rise to the supposition that the tumor may be a fibro-calcareous growth and in the latter that it may be melanotic, which also, if a rupture of a blood vessel should occur, would be easy to mistake and diagnose as a simple sanguineous cyst. The surgeon should be upon his guard in making a diagnosis. Fig. 791 shows spindle-celled sarcoma of spleen.

MICROSCOPIC APPEARANCES. Spindle-celled sarcomata are histologically divided into the small- and large-celled.

The small spindle-celled sarcoma, Plate XXXII, Fig. 2, presents a characteristic appearance. On a deep red background myriads of oval and spindle-shaped blue nuclei run in wavy or circling lines across the field. In some places there appear to be groups of small round cells. These are simply cross sections of the spindles. The true spindle-celled sarcoma contains very few if any round cells. (Hamilton.)

The basis substance is usually scanty. It may be delicately fibrillated. Blood vessels are not usually numerous and are more perfectly developed than in the round-celled sarcoma.

The large spindle-celled sarcoma is shown in Plate XXXII, Fig. 3. Where the section is thick or the cells massed closely together, as in the right side of the picture, there is seen simply a group of large oval nuclei on a scanty pink background. In the center of the picture the section is thinner and the graceful outlines of the spindles are well shown. In the upper left corner a bundle of spindle cells, seen in cross section, resembles a group of round cells. The cells are from three to four times larger than those of the small spindle-celled sarcoma. The basement substance is scanty and hyaline. Blood vessels are usually numerous and extravasations of blood frequent.

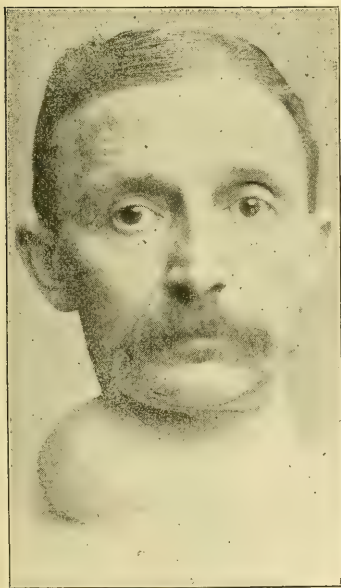


Fig. 792.
Giant-Celled Sarcoma of Neck.
—Helmuth.

The large spindle-celled sarcoma is a very malignant tumor, as it forms early and rapidly growing metastases. The malignancy is directly proportionate to the large size of the spindle cells, and to the prevalence of spindles with more than one nucleus.

Giant-Celled Sarcoma, or Myeloid Sarcoma.—These are generally found in the long bones and are of a deep reddish or maroon color; they also spring from the periosteum, or may be central. (Fig. 792). They often grow with great rapidity; they are smooth tumors, somewhat elastic, with

enlargement of the subcutaneous veins, and when they occur in the jaw may be mistaken for epulis—which in its character is innocent and is

placed among the fibromata. This variety of sarcoma is said to be the least malignant of all the varieties of sarcoma; the author's experience does not bear out this assertion, for he has found central myeloid tumors, both in the long bones and in the lower jaw, proceed rapidly, even after apparently complete removal, to a fatal termination.

It is quite probable from the embryonic and heterologous nature of the cellular elements in glioma, cylindroma, and myxoma, that these tumors would recur after removal, and, therefore, might well be placed among the semi-malignant growths.

MICROSCOPIC APPEARANCES. The giant-celled sarcoma or myeloid sarcoma, as in Plate XXXII, Fig. 7, is never composed entirely of giant cells. These bodies, when present, are embedded, in a greater or less profusion, in a small spindle- or mixed-celled sarcoma; less frequently in the pure round-celled form.

The giant cells are more numerous in sarcomata which grow in the medullary cavity than in those which originate in the periosteum. To account for their presence it is supposed that, as the bone is destroyed in the growth of the tumor, the bone corpuscles and the bone-forming cells of the deep layer of the periosteum are liberated and entangled in the meshes of the tumor. These cells return to their embryonic form, which was that of a giant cell. Sometimes these giant cells regain their functional activity; they divide into osteoblasts, which arrange themselves around a blood vessel and begin to deposit a bony matrix. In this way small bits of bone are sometimes found scattered through the tumor, which is then called osteo-sarcoma or ossifying sarcoma.

The mixed-celled sarcoma, Plate XXXII, Fig. 8, is a sarcoma which is composed of round, spindle and giant cells, mingled in varying proportions. The tumor from which this specimen was taken originated in the medullary cavity of the femur.

Round-Celled Sarcomata.—These are softer to the touch than the spindle-celled, and it is sometimes difficult to diagnose them from encephaloid cancer. Experience shows two great differences which are always well marked in cases of true sarcomatous tumors, and these are the absence of hemorrhage and the non-infiltration of the parts.

MICROSCOPIC APPEARANCES. Round-celled sarcomata are of two varieties, the large and the small.

The small round-celled sarcoma, as drawn on Plate XXXII, Fig. 1, is composed of a mass of small round cells, embedded in a gelatinous basis substance. The appearance of stained specimens, under a low magnifying power (30-100), is that of a mass of small, purple dots, indistinguishable from the appearance of a lymph node or of lymphoid tissue generally. Under higher powers (300-500) the cells are seen to be about the size and shape of white blood corpuscles or lymphoid cells. As in the lymphoid cells, the nucleus appears to occupy the entire cell body. By careful focusing, however, a delicate red rim may be seen around the nucleus. This represents the projecting cell body, stained with eosin. These cells are also shown in the lympho-sarcoma, Plate XXXII, Fig. 5. Round cells of somewhat larger size are usually scattered among the small ones. Blood vessels appear in the picture as delicate black circles and irregularly outlined forms. The narrow black line consists of endothelia which are seen on edge. The nuclei of the endothelia appear as

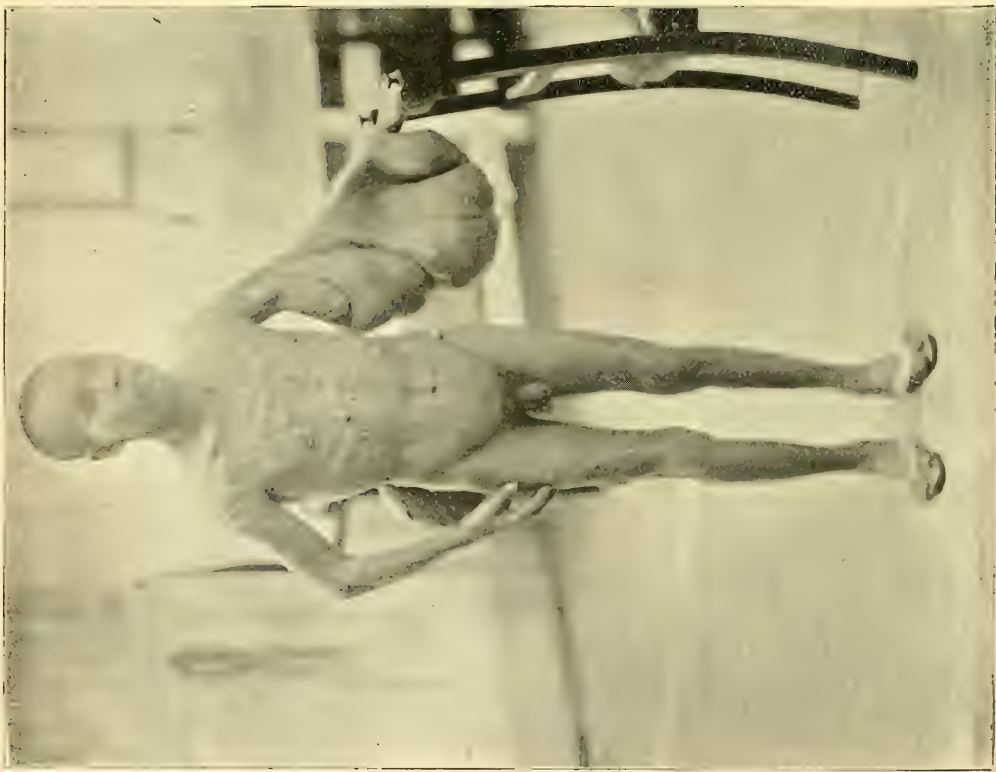


Figure 1. Front View.

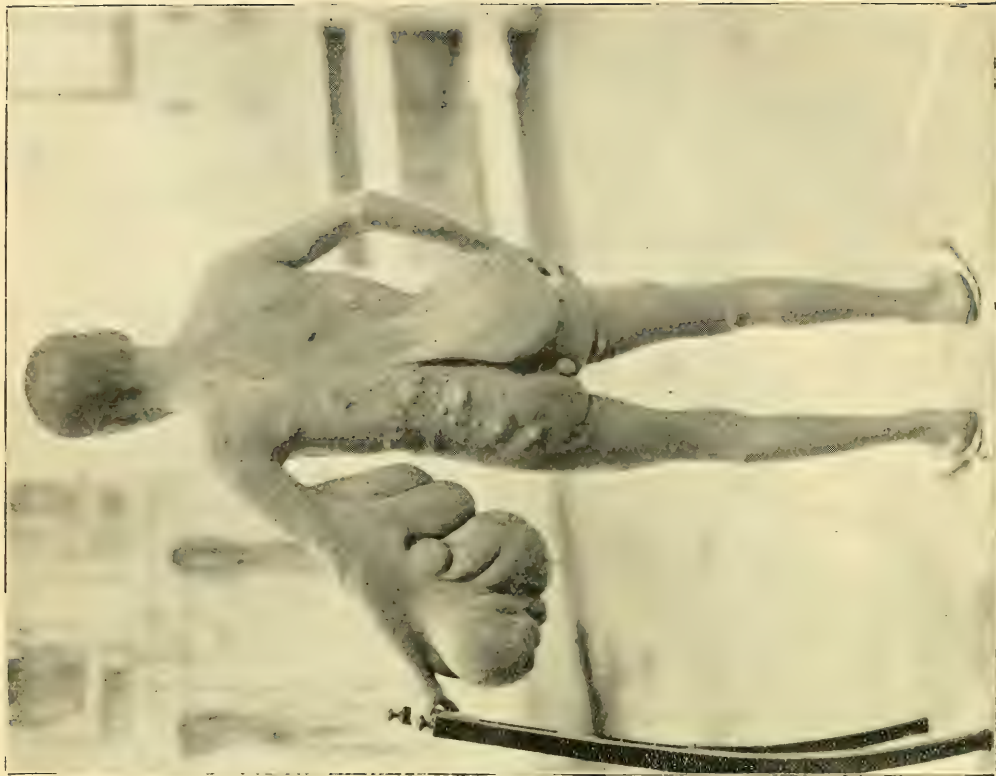


Figure 2. Rear View.

Molluscum Fibrosum, Seen by Author in Japan (Tokio).—HELMUTH.

small knobs projecting into the lumen of the vessel, and placed at regular intervals along its walls. Extravasations of blood are common. (Plate XXXII, Fig. 1). They appear as groups of recognizable red blood-corpuscles, or as masses of orange-brown pigment which is degenerating hemaglobin. This pigment should not be mistaken for that of melanotic sarcoma, (Plate XXXII, Fig. 6). (See Melanotic Sarcoma.)

Specimens taken from the margin of the tumor show that the normal tissue in which the tumor grows contains long lines of small round cells, which seem to represent an advancing infiltration by the tumor elements. Such tumors should, therefore, be removed by wide incisions.

Large round-celled sarcomata, (Plate XXXII, Fig. 4), resemble in all respects the structure of the small round-celled variety, except that the cells are from three to five times larger. Each cell contains one or more large oval nuclei. A variable number of small round cells and also spindle cells is usually present; the spindle cells, as in Plate XXXII, Fig. 4, being arranged to form the walls of blood channels.

GLIOMA. This is a peculiar form of round-celled sarcoma, but differs materially from the myeloid formation in the character of its cells and the localities it occupies. The cells of glioma are round and small, and the cell-elements resemble those found in the brain; some of the cells show prolongations, which tend to the formation of a reticulated substance. The seat of the tumor is generally in the retina and in the gray, sometimes in the white, substance of the brain, and spinal cord.

MICROSCOPIC APPEARANCES. In chronic epilepsy and other diseases of the central nervous system hard, cartilage-like masses are sometimes found in the brain cortex or medulla. They are made up of a mass of spindle cells or Deiters' cells with a variable amount of fibrous connective tissue. Microscopically the tumor appears like a condensation of the normal connective tissue framework of the part. Most authors, including Virchow, class these neuroglia-like masses as true tumors under the term neuroglioma, or simply glioma; others regard them as inflammatory thickenings or pure hyperplasie. In themselves the gliomata are perfectly benign, except as far as the accident of their location is concerned. The term glioma is sometimes used to indicate the gliosarcoma, which is a very different and most malignant neoplasm. Gliomata are very subject to fatty, calcareous or myxomatous degeneration.

Lympho-Sarcomata.—These have been mentioned in the section on lymphadenoma.

MICROSCOPIC APPEARANCES. The lympho-sarcoma (Plate XXXII, Fig. 5) is a small round-celled sarcoma, in which the round cells are supported by a delicate, fibrous reticulum, which is not sufficiently prominent, however, to place the tumor in Ziegler's second class. Stained specimens resemble the appearance of ordinary small round-celled sarcoma, when seen under a low power.

In this form some of the sarcoma cells have the power of depositing around themselves a scanty, fibrous basis substance; though the major part of the tumor elements simply reproduce themselves as round cells, after the fashion of sarcomata generally.

Hodgkin's disease, or adenia, presents a close microscopic similarity to lympho-sarcoma. While some pathologists give minute directions for

making the distinction between these growths it is safer to base the differentiation on the clinical symptoms of rapid growth and the formation of metastases than upon microscopic examination. In the author's opinion it is very hard to distinguish between these growths. In every advanced stage of lymphadenoma he has found leukemia and a tendency to degenerate. In Hodgkin's disease the glands do not tend to coalesce; the outlines of the original glands are usually discernible—whereas, in true lympho-sarcoma all definition of separate glands is lost in one large tumor mass.

Alveolar Sarcoma.—This is but another form of the round-celled variety and was first described by Billroth; it adds another to the innumerable list. These sarcomata appear in the muscles and bone, and frequently in the skin (Fig. 793), where they become very numerous and proceed to ulceration, giving rise to considerable deformity. Like all other sarcomata they recur frequently, and the treatment is complete removal by the knife or cautery.

The author has purposely excluded from this chapter, of a work designed especially for students, the many varieties of sarcoma which are constantly being described. The more he has studied the subject, and the more extended his experience, the more he arrives at the fact that as all these tumors overlap, or rather intermingle their anatomical and histological elements, there may occur to every surgeon, and to the same surgeon many times, cases of sarcomata with more or less development of other tissues, and it has been the endeavor to name each of these classes that has given and will give forever an unlimited field for the cultivation and production of every variety of sarcoma.



Fig. 793.
Alveolar Sarcoma Resembling Medullary Carcinoma.

MICROSCOPIC APPEARANCES. The alveolar sarcoma (Plate XXXIII, Figs. 7 and 8) is a tumor of mesoblastic and not epithelial origin. At first sight this tumor resembles medullary cancer, especially with low magnifying powers, as may be seen by comparing it with Fig. 7 on Plate XXXI. In each of the low power drawings there is seen a well marked stroma of red fibrous tissue which encloses large masses of blue dots, the dots representing the nuclei of cells which are arranged in well defined groups. There is some difference in the color of the two tumors, because the section of alveolar sarcoma is very thin and has been lightly stained, while that of medullary cancer is thick and has taken the hematoxylin stain heavily.

On examining the adjoining high power drawing of each tumor it will be seen that in medullary carcinoma, first, the edge of the fibrous stroma is sharp and clean cut; second, the epithelial mass is distinctly separated from the fibrous stroma; third, the epithelia in the mass are closely packed together, with no evident fibrous or other intercellular substance intervening between the cells.

Whereas, in alveolar sarcoma, first, the edge of the fibrous stroma is not sharply defined but ragged; second, fibrous strands run out from the stroma among the cells, making a close attachment between the cells and

the stroma, which is never the case in cancer; third, the cells are divided into groups of two and three by a delicate inner fibrous mesh-work, which is continuous with the coarser fibrous stroma. This is never seen in cancer.

In a broad way the structure of alveolar sarcoma resembles that of a lymph gland. The cells themselves are usually large, round and often multi-nucleated. They cannot be surely distinguished from epithelia; unless, as is sometimes the case, the cells are seen to be attached to the margin of the stroma by slender pedicles, as if they were budding out from the fibrous tissue. There is a resemblance to the structure of carcinoma in the fact noted by Ziegler, that in the alveolar sarcoma the blood vessels run entirely in the coarse fibrous stroma and do not penetrate the large cell masses.

Melano-Sarcoma.—By the term melano-sarcoma or melanotic sarcoma is meant any sarcoma of Ziegler's first or second class (most frequently round, spindle or alveolar sarcomata, in the order named), the cells of which contain particles of a brown or black pigment known as melanine. Such a tumor is drawn on Plate XXXII, Fig. 6. On examining such a tumor with a power of 300 or more diameters it will be observed that the particles of orange-brown and black pigment lie in the substance of the cell; that is, in exactly the same focus as the cell body, being seldom observed in the intercellular substance around, over or under the sarcoma cells. This point will distinguish melanine from the pigment of extravasated blood, which it closely resembles. Extravasated blood pigment is represented in Fig. 1 of the same plate. Here, the outlines of the red blood corpuscles are often to be discerned. In case these have disintegrated the resulting pigment is seen to lie around about the cells, but never within them. The pigment of melano-sarcomata appears first in the body of the cell and next within the nucleus. When the pigment granules have accumulated in great number the sarcoma cell sometimes disintegrates, as is shown at several points in Fig. 6.

This melanine is a product of the vital activity of the cells. The melano-sarcoma usually grows from connective tissue cells which normally have the power of elaborating a pigment, as the corpuscles of the choroid coat of the eye. In its growth the pigment-bearing corpuscles of the choroid proliferate to form the sarcoma cells and their descendants in the tumor, here and there, retain the pigment-forming power of the original choroid corpuscle. This seems to be analogous to the cartilage and bone-making power which is displayed by some sarcomata growing from these tissues.

Melano-sarcomata are intensely malignant, reproducing themselves rapidly by the lymphatics as well as by the blood vessels. They almost always continue the elaboration of pigment and may even contain more melanine than did the primary tumor. The pigment accumulates not only in the elements of the sarcoma, but also in the neighboring cells of the organ in which the tumor is lodged, in the walls of the blood vessels and in the peri-vascular connective tissue.

Melanine was formerly supposed to be simply degenerating blood pigment. That it is something entirely different from the pigment left by old blood extravasations has been determined by its behavior with chemical reagents.

Lesser Varieties of Sarcomata.—**ADENO-SARCOMA.** A sarcoma containing newly formed gland tubules.

ANGEIO-SARCOMA. A sarcoma containing very many capillary blood vessels, many of which are varicose. Also a tumor presenting a tubular or alveolar structure, allied to endothelioma.

CHLOROMA. A rare tumor of the cranial periosteum, whose freshly cut surface is greenish in color, changing, on exposure, to brown. It is a lympho-sarcoma, the cells of which contain glistening granules chemically resembling fat.

CHONDRO-SARCOMA. A sarcoma containing areas of hyaline cartilage. It is apt to contain fat, myxomatous and glandular tissue as well.

CYLINDROMA. A term that has been applied to four neoplasms.

A. A sarcoma containing areas of hyaline or myxomatous degeneration. (Fig. 794.)

B. An angio-sarcoma, presenting the same features as "A."

C. A rare form of carcinoma, in which either the epithelia or the fibrous stroma undergo hyaline degeneration.

D. Billroth's cylindroma is a sarcoma in which branching masses of cells penetrate the surrounding tissue. Blood vessels are projected into them. The tumor closely resembles angio-sarcoma.

CYSTO-SARCOMA. A sarcoma containing cysts formed either by the degeneration of sarcoma substance or by the obstruction and subsequent dilatation of gland tubules. Blood cysts are frequently sarcomata in which interstitial hemorrhage and disintegration have taken place.

FIBRO-SARCOMA. A small spindle-celled sarcoma containing broad areas of fibrous tissue. It is an intermediate form between sarcoma and fibroma.

LIPO-SARCOMA, LIPOMATOUS SARCOMA. A sarcoma containing fat tissue, much of which is supposed to be of new formation.

MIXED-CELLED SARCOMA (Plate XXXII, Fig. 8). A sarcoma of the first-class composed of round, spindle and giant cells in varying proportions.

MYO-SARCOMA. A rare form of spindle-celled sarcoma occurring in the uterus in which the spindles are indistinguishable from those of involuntary muscles.

OSTEO-SARCOMA, OSSIFYING SARCOMA. See giant-celled sarcoma.

OSTEOID-SARCOMA. A very malignant sarcoma in which there is calcification but not true ossification. The cells are somewhat larger than those of the small round-celled sarcoma.

PSAMMOMA, ANGEIO-LITHIC SARCOMA. A tumor containing sandy concretions, which grows from the choroid plexus, the pineal gland and the membranes and ventricles of the brain. It is composed of many capillary blood vessels, around each of which is a thick sheathing of endothelial cells infiltrated with the salts of lime.



Fig. 794.
Myxo-Sarcoma. (Cylindroma). From
Pelvis of Kidney.

Areas of degeneration bounded by branching corpuscles; contain scattered nuclei which resist degenerative change longer than does the cell body. In middle of field is giant-cell showing degeneration commencing at centre. Specimen hardened in alcohol; stained with picro-carmin; mounted in glycerine: x300—Laidlaw.

Endothelioma.—Endothelioma, the endothelial sarcoma, is a tumor which develops from pre-existing endothelia, and occurs as a circumscribed or a diffuse growth in the serous membranes lining the great cavities, and especially those which line the brain and cord. The endothelia involved are those which line the lymph spaces; they proliferate and form solid or tubular masses within the meshes of the original fibrous tissue, which now becomes an alveolar stroma carrying blood vessels. The lumen, when present, represents the old lymph channel. The tumor resembles columnar-celled epithelioma. The masses of endothelia are seen on both longitudinal and cross section. When isolated the tumor cells resemble more or less the normal endothelia, or they may be very thick and even cuboidal in form.

CHAPTER VII. CARCINOMA OR CANCER.

Definitive Considerations.—A carcinoma is a neoplasm, with a basis of connective tissue, containing groups of epithelial cells, indiscriminately massed together without order or arrangement. The tumor has a tendency to infiltration, excessive cell proliferation, glandular enlargements, cachexia, ulcerations, proliferations, hemorrhages, excessive asthenia and death, and receives varied names according to the characteristic structure embraced in the neoplasm. With the most recent nomenclature,* the student is likely to become confused, and therefore while as much of it as is possible is inserted in the text, to keep abreast of the times, enough is allowed to remain of the time-established classifications to render reference to the older works intelligible, and both arrangements appreciable. As much prominence as possible is given to the clinical aspect of the subject, lest in the present bewildering labyrinth of cell proliferation this most important factor in diagnosis should be entirely lost.

It is not by any means certain after a fair consideration of all the facts that the old morphological definitions did not convey to the mind the actual clinical significance of a new growth more definitely than the labored and many hyphenated terms of the microscopists. A cauliflower excrescence—a fungus hematodes—an encephaloid and a scirrhus present to the mind of the surgeon a much more sharply-defined clinical picture than the multitude of histological names adopted by the pathologists and the microscopists.

The great distinction between true cancer and the innocent tumor with reference to auto-infection is this: in the latter the parts are pushed asunder, a separation of tissue taking place; in the former the surrounding tissues are infiltrated with the cancerous material.

Again, another of the peculiar marks of cancer consists in the glandular enlargements which follow its growth. If a tumor is found which is apparently innocent in its characteristics, accompanied during its life with neighboring lymphatic or adenoid swelling, it must at least be regarded as suspicious in its character.

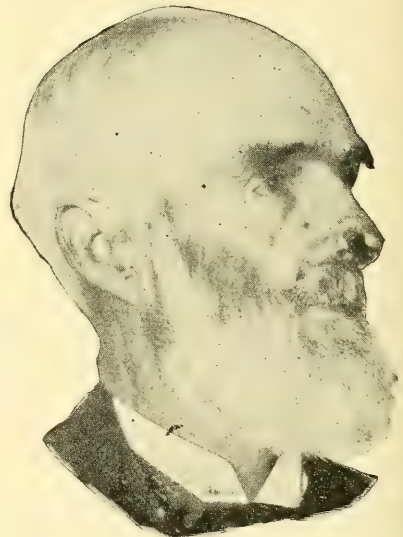


Fig. 795.
Carcinoma of Nose.—Shears.

*Mr. Snow thus writes: "Carcinoma expresses cancer of one variety only, that derived from epithelial cells of acinous secreting glands." *A Treatise, Practical and Theoretic, on Cancer and the Cancer Processes*, by Herbert Snow, M. D., p. 128. London, 1893.
(1246)

It has been supposed by some that the primary origin of cancer is to be looked for in a deviation from the healthy standard of nutrition, and that there exists in some an hereditary predisposition to this abnormal action; that though this tendency may exist for years latent in the system yet it ultimately develops itself either from known or unknown causes in the form of one or other of those tumors known as cancerous. Certain it is that in the majority of cases of cancer that have come under the author's supervision during the last fifteen or twenty years he has been able to trace a cancerous disease somewhere in the family. At first this predisposition may be denied on the part of the patient, from ignorance of the actual facts, but upon carefully inquiring it has been found that "cancer" somewhere existed more or less remotely. It may be said that this heredity may sometimes skip a generation, and appear again with redoubled violence in the same family.

With the peculiarity just noticed there is another which should be observed, which consists in the fact that those causes which produce ordinary diseases do not appear to have much influence in the production of cancer; and that all classes are more or less liable to its invasion; nor, indeed, does impaired health appear to be a factor in its production. The author has known, in several instances, a true scirrhus tumor to exist for years, in the person of a wretchedly poor, ill-fed, dyspeptic, and hysterical woman, and, with the exception of occasional pain, be of no inconvenience.

Classification.—The carcinomas as per the table are arranged as follows:

First. Acinous cancer or gland-celled carcinoma (carcinoma simplex or common cancer) includes the clinical varieties of scirrhus and medullary or encephaloid carcinoma.

Second. Epithelioma includes the clinical varieties of "skin cancer," or squamous-celled epithelioma, which develops on surfaces covered by stratified epithelium, and the columnar-celled epithelioma or cylindrical-celled epithelioma (malignant adenoma or adenoid cancer), which is the form that occurs on richly glandular mucous membranes.

Third. Colloid cancer, carcinoma myxomatodes, carcinoma cylindromatosum, and melano-carcinoma are cancers of classes first and second which have undergone colloid, myxomatous, hyaline or pigmentary degeneration, respectively.

It should be remembered that all these forms are simply varieties of one and the same pathological process, which process is the atypical overgrowth of epithelia. The different forms merge into one another; epitheliomata are prone to take on the characteristic structure of acinous cancer and both forms are subject to the degenerations which constitute class third.

The microscopic appearances of the different stages of carcinoma will be best understood by studying the development of each of the three classes from pre-existing normal epithelium, as represented in Plate XXXI and XXXIII, which were drawn from specimens mounted in the laboratory of the New York Homeopathic Medical College. The drawings represent accurately the natural appearances.

Acinous Carcinoma.—This is also called spheroidal-celled carcinoma. If there is an appreciable amount of fibrous tissue in the tumor

it is the scirrhus, or hard cancer of the older surgeons. It is said that hard cancer is the most frequent form of cancer; in his experience the author has not found it so, and thinks that in America, at least in those sections in which he has had an opportunity of observing the disease, epithelioma is the more frequent. The occurrence of fibroma and adenoma in the female breast may have given rise, in part, to the statement regarding the frequency of scirrhus, the one being mistaken for the other.

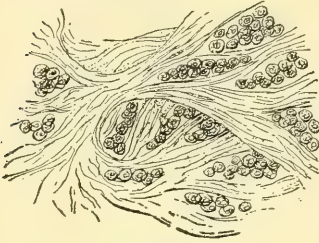


Fig. 796.
Acinous Carcinoma, Left Breast.
x300.—Helmuth.

A scirrhus tumor is hard, nodulated, and circumscribed; its chief peculiarity and its diagnostic mark is its tendency to contraction, or the drawing around it of all the tissues. It frequently happens in a woman affected with this disease that a healthy, well-developed breast exists on the one side and a shriveled, drawn, potato-like excrescence on the other. This mark (contraction), together with its tendency to adhesions to the underlying and superincumbent structures, may be said to be pathognomonic of the disease. No other tumor possesses these peculiarities to such a degree.

There is often noticed in the growth of such a tumor a peculiar increase, either in the middle or on one side or the other; by careful observation it will generally be seen that the most marked increase in structure is found at that point where there is most nutrition; in other words, near the largest artery. It is an undoubted fact that scirrhus withers of itself; especially is this true of breast cancers. This withering of scirrhus has been found by most careful observers not to consist in its transformation into other tissues, nor in its conversion into healthy structure. It is merely a breaking up of the cells and nuclei, and the escape of oil-globules and debris.

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A somewhat peculiar feature of this cancer is the "cupping" of its surfaces. When cut into, after its removal from the body, the sections become concave, the surface shining, the substance elastic and glistening. This pitting is explained by the tendency, which has been before noticed, to contraction inherent in the growth.

The pain is not severe in the early stages; indeed, a tumor may exist for a time and be by accident discovered. There is, however, always soreness of the "lump" when handled, and sharp, lancinating pains which are peculiar. As the disease advances these darting pains become more frequent and severe; these, though peculiar to most forms of carcinoma, are much more severe in hard cancer, being probably due to the pressure exerted by so firm a growth on the nerve-fibres. Glandular enlargement also is another most prominent symptom, which is more peculiar to this variety than perhaps to the other forms of cancer.

After a time ulceration sets in and the action is then rapid, the discharges are thin and offensive, the ulcer is jagged and ill-defined. With these symptoms the cachexia is well marked, and the usual manifestations of decline are present.

Acinous or spheroidal-celled carcinoma, with absence of fibrous material, is called also encephaloid cancer. This form of carcinoma has received several appellations, chiefly from the appearances it presents. The

fungus hematodes and fungus melanodes of the old writers and the soft or medullary cancer of the more recent authors are synonymous. There are two distinct forms of encephaloid disease; the one appearing as a round and defined growth, the other being nothing more than intense and perfect infiltration; the latter is often found in serous membranes, and also in the bones. The former are "boggy" in their feel, and generally enclosed within a delicate capsule, which sends trabeculæ into the substance of the tissue, dividing it into compartments, each of which may also have a covering of connective tissue. In the other variety the tumor is not so distinctly marked, though the elevation rises above the surrounding structure and presents such elasticity that fluctuation is apparently present. On more than one occasion these fluctuating tumors have been punctured with the expectation of finding either serum or pus.

These cancers are always profusely supplied with blood vessels, which have exceedingly delicate walls and which are in size much out of proportion to the structure through which they ramify. Besides this internal vascularity the veins on the surface of the tumor are enlarged and tortuous. It is from this supply of vessels, especially if the cancerous growth is bound down by dense tissue, that there may be distinct pulsation in the tumor.

A peculiarity of this variety of cancer is found in the fact that it may exist with the hard variety in the same patient, and that all ages are liable to its invasion. It has been found in the fetus at birth. The sufferings of those affected with the soft variety of spheroidal-celled carcinoma are, as a rule, not so great as are found in the harder variety, particularly if the disease appears in soft and yielding structures; there is often, however, extreme suffering.

The testicle, uterus, eye, and female breast, the bladder and the face are also often affected.

As the disease progresses a bluish spot near the surface becomes visible. The integument becomes thinner and thinner, until it ulcerates, generally with profuse hemorrhage. Almost immediately from this opening there sprouts a red, soft, fungoid, readily-bleeding mass, which grows with great rapidity and undermines the health of the patient with marvellous speed. The cancerous cachexia is more marked than almost any other, and is noticeable even in the earlier stages. A rare case of fungus hematodes, or melanotic cancer, occurring in the practice of Kanouse, Wausau, Wisconsin, is shown in Fig. 2, Plate L. Though there were premonitory symptoms extending over a period of some years the enormous growth shown in the illustration, eight inches in length by five inches in diameter at the base, developed from a slight abrasion of the integument within a period of five days. Death occurred from hemorrhage.

The "cancer juice" pressed from one of these tumors is of yellowish



Fig. 797.

Hard Spheroidal-Celled Carcinoma. The clear spaces between the epithelial groups and the fibrous tissue were caused by shrinking of the tissue in the hardening fluid. Specimen hardened in alcohol, mounted in glycerin. $\times 300$. - Laidlaw.

or milky hue; the stroma is reticulated and spread out like a net, within the meshes of which are found the cancer-cells already mentioned floating in a liquid intercellular substance. The cells vary in form, being caudate or pyriform, and have many nuclei. The progress of soft cancer is rapid, the duration of life under its ravages not often exceeding two years. Death often occurs from actual exhaustion. The following from Gross, is the differential diagnosis:

CLINICAL CLASSIFICATION. GLANDULAR-CELLED CARCINOMA (Spheroidal-celled:)

- SOFT.
1. The tumor is soft and elastic, not uniformly, but more at some points than others.
 2. It grows rapidly and soon acquires a large size—perhaps ultimately attaining the bulk of an adult head.
 3. The pain is slight and erratic, until ulceration sets in, when it becomes more severe and fixed.
 4. There is always marked enlargement of the subcutaneous veins.
 5. The ulcer is foul and fungous, with thin, undermined and livid edges, and is subject to frequent and copious hemorrhages.
 6. There is generally early lymphatic involvement.
 7. Occurs at all periods of life.
 8. Is most frequent in the eye, testicle, mamma, lymphatic ganglions, bones, skin and cellular tissue.
 9. The disease usually terminates fatally in from nine to twelve months.

- HARD.
1. Uniformly hard and inelastic, feeling like a marble beneath the skin.
 2. Growth is slow and bulk comparatively small; the tumor rarely, even in the worst cases, exceeding the volume of a double fist.
 3. The pain begins early, is distinctly localized and is of a sharp, darting, burning, or lancinating character.
 4. These vessels retain their natural size, or are only slightly enlarged.
 5. The ulcer is incrustated with spoiled lymph, and has steep, abrupt edges, looking as if it had been scooped out of the part, bleeding little and seldom.
 6. Usually not until late, or just before ulceration is about to occur.
 7. Seldom before the age of forty-five.
 8. Never occurs in the eye and testicle and rarely in the bones, skin and lymphatic ganglions.
 9. Seldom sooner than eighteen months or two years.

MICROSCOPICAL APPEARANCES. Acinous, spheroidal-celled, or glandular-celled carcinoma, embracing scirrhus (hard), medullary (soft) cancer.

The most common location of these tumors is the female breast. Plate XXXI, Fig. 1, represents the normal non-lactating female breast under low magnifying power (40 diameters). There are broad fields of red fibrous connective tissue containing widely scattered groups of acini. A group of acini is shown in Plate XXXI, Fig. 1. They appear as aggregated round masses of purple dots. The aggregation of acini is divisible into three or four secondary groups, each of which is composed of from four to eight acini. In Fig. 2 the lower right-hand group has been magnified by 500 diameters. It will be seen that the purple dots of the acini represent the nuclei of small pink-bodied epithelia which are of the cuboidal or flattened columnar type. The epithelia seem to fill the acinus completely, leaving no central lumen; this appearance is common in normal acinous glands and must not be mistaken for the structure of cancer. At the right is a cross section of a duct which has a wide lumen, and is lined by a double layer of polyhedral epithelia. Note that under both low and high powers the epithelia seem to be contained entirely within the acini, and that the margin of the acinus is sharp and distinct. The connective tissue corpuscles appear in Fig. 1, as minute purple streaks or dots lying in the red fibrous tissue; in Fig. 2 they are seen to be mostly spindle-shaped, with here and there a small round cell.

In the beginning of a breast cancer seen under low power, as in Fig. 3, we find, in the place of discrete and well marked acini, irregular masses of purple dots which stream off into the fibrous tissue in tapering lines. Under the higher magnifying power, in Fig. 4, it is seen that each purple dot is the nucleus of an epithelium; that the epithelia have multiplied enormously, so as to distend the acini and tubules in which they lie. Fig. 4 shows the upper part of such a distended acinus. Not only are the acini distended but the mass of growing cells has apparently burst through the basement membrane of the gland and some of them have escaped into the interstices of the surrounding fibrous tissue. These escaped epithelia must be carefully distinguished from the neighboring connective tissue corpuscles, which are spindle-shaped, and from the small round cells of inflammation or tissue repair, which are of frequent occurrence in all fibrous tissue. The "round cells" are smaller than epithelia; they are round and the nucleus fills up almost the entire cell; whereas, the epithelia have broad, pink bodies, which are cuboidal or columnar, the nucleus is located in the centre or at one end of the cell, and there is ample breadth of cell body around the nucleus.

The fibrous stroma at first consists simply of the pre-existing fibrous connective tissue of the breast. The advancing epithelia seem to act like other foreign bodies which invade connective tissue; they call forth a quasi-inflammatory reaction, resulting in the formation of a surrounding capsule of dense fibrous tissue.

The lymph spaces of the capsule are its vulnerable points, and through these narrow lymph spaces the epithelia float out beyond the investing capsule. Wherever they lodge there is a new growth of restraining fibrous tissue which is as futile as before.

The fully formed cancer is represented in Figs. 5, 6, 7 and 8. Fig. 5 shows the solid masses of epithelia lying in the fibrous stroma. It gives the typical appearance of acinous or common cancer under a low magnifying power. In Fig. 6, with a power of 500 diameters, the solid masses of cuboidal epithelia, lying in the distended lymph spaces of the fibrous tissue, are easily recognized.

In the early stages of such a carcinoma the epithelial groups are usually small and widely scattered, and the fibrous tissue is present in large amount. Such a cancer is called a scirrhus or hard cancer. Its growth is usually slow.

On the other hand, if in this cancer the epithelial growth becomes more rapid, so rapid that limiting walls of fibrous connective tissue are not well formed, the tumor comes to be composed of large masses of epithelia with a very scanty amount of fibrous tissue, Plate XXXI, Figs. 7 and 8. The tumor is soft, sometimes almost mushy in consistence, and is then called encephaloid or medullary cancer, from its resemblance to brain substance and marrow, respectively, or carcinoma molle which is anglicized as soft cancer. Microscopically, as in Fig. 7, the preponderance of cell masses and the scanty amount of connective tissue of medullary cancer, are easily seen. So numerous are the cell nuclei that the tumor looks like a lymph node or a round-celled sarcoma. With higher magnifying power (300-500), as in Fig. 8, it will be seen that the cells are broad, cuboidal epithelia; that they are massed in a solid group; and that they are distinctly separated from the sharp border of the fibrous stroma. These features stamp the tumor as a cancer and dis-

tinguish it from alveolar sarcoma. In alveolar sarcoma, as in Plate XXXIII, Fig. 8, the cell masses and the fibrous stroma are intimately mingled, as described in the paragraph on alveolar sarcoma. Whenever a scirrhus tumor begins to grow rapidly it assumes a medullary form. Scirrhus carcinomata that recur after removal are almost invariably medullary in their recurrent form, which fact indicates that medullary cancer is a more rapidly growing and, therefore, more virulent form of scirrhus.

Epithelioma—Squamous-celled Carcinoma.—Epithelioma, as its name implies, is that form of cancer which bears some resemblance to the epithelial structure of the human body. It possesses all the characteristics of the ordinary malignant formations, and is found especially in the skin, the lip, the tongue, the penis, the os uteri and rectum, as well as the pharynx, larynx, esophagus and vagina.

It generally begins as a wart, or a fissure, or a tubercle, and spreads by infiltration. (Fig. 798). It in many cases becomes fungoid, and then the peculiar papillary structure can be discerned by the naked eye. There are two peculiarities which the author has carefully noted in this disease, and these are: First, the length of time that the disease may rest locally in the system without harm being done; and, second, speaking purely from individual experience, it is less likely to return than any other form of carcinomatous disease; at all events the patients have a longer immunity from it when the growth is early and thoroughly removed.



Fig. 798.
Squamous-Celled Carcinoma of
Chin and Neck.—Helmut.

There is one peculiar method in which it may make its appearance which deserves attention. It is when there appears to be formed over an abrasion of the skin, or a round red spot, an hypertrophied, epithelial structure, a dry scale which, upon being removed, again develops; when this scurf is removed a small quantity of moisture shows beneath, but nothing more. Gradually, however, the papillæ are enlarged, and, indeed, often become enormous; then there appears to be considerable ichor exuded, and the structures show symptoms of infiltration, which soon ravages the parts around. This may be called the second stage of epithelioma. In some cases it has been noticed that as the ulcerative process goes on there is a deposition of new growth at the sides and borders of the chasms. Men are said to be more liable to epithelioma than women, though I have seen many cases in the female, especially in the uterus and vulva.

In this variety of cancer there seems to be also a local irritation existing in most cases. Thus, the heat of the clay pipe on the lip of smokers, the soot in the scrotum of the chimney-sweep, or the irritation of old warts or moles, often, indeed in the majority of instances, lead to the development of epithelioma.

MICROSCOPICAL APPEARANCES. The form of carcinoma which begins on a gross epithelial surface and ulcerates presents two varieties:

a. Squamous-celled epithelioma, flat-celled epithelioma or "skin

cancer," originates on surfaces that are covered by stratified epithelium, as the skin, the mouth, pharynx, larynx, esophagus, vagina, cervix and the urinary and gall bladders.

b. Columnar-celled epithelioma, or cylindrical-celled epithelioma, arises from a surface covered with glandular epithelia, as the mucous membranes of the alimentary canal and uterus.

a. The development of squamous-celled epithelioma is shown in Plate XXXIII, Fig. 5, which was taken from the edge of an epitheliomatous ulcer of the groin. On the left of the picture is seen normal skin. Short fibrous papillæ, pink in color, project upward from the fibrous derma. They are covered by stratified epithelium. The lower layer of the epithelial investment is red and is sprinkled with purple dots, which represent the nuclei of the cuboidal and columnar epithelia of the rete Malpighii; while the upper portion is yellowish-red or yellow, and represents the stratum corneum. There is a thin basement membrane which separates the layer of columnar epithelia from the subjacent fibrous derma, just as the basement membrane of the gland tubule separates its epithelia from the surrounding fibrous tissue. The skin contains other epithelial elements not shown in the picture. These are the sebaceous and sweat glands and the hair follicles.

Passing further to the right, at the edge of the ulcer, notice that the pink-bodied epithelia have commenced to grow downward into the derma, that the epithelia of the rete Malpighii have burst through the basement membrane and are invading and distending the lymph spaces of the derma, just as do the glandular epithelia in the development of breast cancer. There is also a proliferation of the epithelia of the sebaceous and sweat glands, and probably, of those of the hair follicles. The growing epithelia distend the lymph spaces of the derma into alveoli, and we have resulting the typical structure of carcinoma.

The characteristic feature of the squamous-celled epithelioma, which distinguishes it from other varieties of carcinoma, is the tendency of the advancing epithelia to whirl around in small vortices in which the epithelia arrange themselves in concentric rings. This vortex is called a cancer nest. In the center or at one side of the vortex is a small lump of glistening substance which stains golden or orange with eosin, that is, it takes the same stain as do the cells of the stratum corneum. This body is called a cancer pearl. It is composed of horny scales like those of the stratum corneum. Three of these vortices and enclosed "pearls" may be seen on close examination of Plate XXXIII, Fig. 5. One of them magnified with a higher power is represented in Fig. 6. It should be remembered that in the normal growth of stratified epithelium the columnar cells of the lower layer produce the overlying cuboidal cells, which, as they approach the surface, assume a squamous form, and finally become thin, structureless, horny scales. On examining Fig. 6, it will be observed that the concentric rings of epithelia preserve this relation one to another, that the outermost epithelia, those which adjoin the cellular fibrous tissues, are columnar or imperfectly so; within them come the squamocuboidal cells, and within these the horny scales which are rolled up in a lump and constitute the cancer pearl. This preservation of the normal epithelial relations in skin cancer is analogous to the preservation of the tubular arrangement in epitheliomata of the mucous membranes (q. v).

In some instances the epithelia in the nest grow with sufficient force to flatten the outermost layers into slender spindles, as shown in Fig. 6. Note that the pink squamous cells are spindle-shaped and distinctly larger than the epithelia of breast cancer, shown in Plate XXXI. It was formerly supposed that both vortex and pearl were diagnostic of epithelioma. They are extremely characteristic, it is true, but similar appearances may be seen in sections of normal skin which has been exposed to irritation, as that of the buttocks, the sole of the foot, or the palm of the hand. Slanting sections through the skin from any part of the body may give an appearance almost indistinguishable from the vortex of epithelioma.

The fibrous connective tissue of such an epithelioma as shown in Plate XXXIII, Figs. 5 and 6, and in the epithelioma of the tongue, Fig. 799, is usually thickly set with small round cells, like lymph corpuscles, which appear as purple dots. This is the "round-celled infiltration" of Virchow, the "pre-stage of cancer" of Heitzmann. The connective tissue is usually scanty and the masses of epithelia, blending with each other, seem to surround small areas of this lymphoid connective tissue, rather than the opposite arrangement which is so marked in scirrhus cancer. The round-celled infiltration usually extends for some distance beyond the epithelial growth. It is claimed by some observers that if any of this round-celled tissue remains after the removal of an epithelioma the tumor will certainly recur. Occasionally the stroma of an epithelioma presents giant cells, which usually adjoin the epithelial masses.

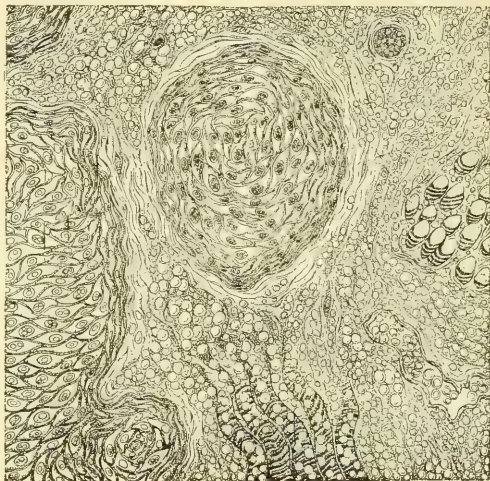


Fig. 799.
Epithelioma of Tongue. (Chromic Acid and Glycerine, x300.)—Laidlaw.

At the extreme right of Plate XXXIII, Fig. 5, is a portion of the surface of the ulcer, formed by masses of the epithelia with intervening strands of lymphoid tissue, in which there are developed many capillary blood vessels.

The well-known hard, elevated margin of an epithelioma consists (Plate XXXIII, Fig. 5) of a similar epithelial thickening.

b. Columnar-celled epithelioma, adenoid cancer or malignant adenoma, is that variety of epithelioma which commences on a mucous membrane composed of tubular glands, as that of the stomach and intestines. It occurs less frequently in the fundus uteri. Clinically these growths manifest all the malignity of carcinomata, in that they indurate the wall of the viscus, invade adjoining structures, constrict, ulcerate, form metastases and develop cachexia. Plate XXXIII, Fig. 2, shows a section of such a tumor taken from the rectum. It is found to be composed of epithelia and fibrous tissue, but the epithelial arrangement differs from other car-

cinomata, in that it is arranged in the form of gland tubules making the tumor apparently an adenoma. On close examination, however, it will be seen that the newly formed gland tubules are not at all typical.

The development of columnar-celled epithelioma is similar to that of acinous cancer and squamous-celled epithelioma. There is, at first, epithelial proliferation in the follicles of Lieberkühn, and the epithelia escape from the follicles and invade the lymph spaces of the tunica propria, submucosa and muscularis.

Carcinomas Which Have Undergone Distinctive Changes.

COLLOID OR GELATINIFORM CANCER—ALVEOLAR CANCER—GUM CANCER.—According to Lebert this form of cancer is found oftener in men than in women and appears most frequently in middle life; it is, however, rarer than scirrhus, encephaloid, or epithelioma. It attacks chiefly the mammae, stomach, intestines and may be present in the system with other forms of the disease.

The colloid matter itself varies greatly in different parts of the body. It generally resembles boiled starch which has been strained but not allowed to become cool. It is slightly bluish in color, although its variations are very great. Sometimes it is greenish, sometimes pink; at others it may be opaque and brown and resemble decomposing tuberculous matter.

The growth and multiplication of colloid are most remarkable. The author has removed two pailfuls of the substance from one patient, and in a second case, in which there were also many tuberculous deposits, about sixteen quarts. In several other cysts of the ovary he has taken away quite enormous quantities of this material.

The main points of this peculiar formation are that it presents structure which is most unlike the usual protein compounds, and is so dissimilar in structure from ordinary cancerous growths that some have denied it a place in the classification of that disease. Of this latter point Paget says that its locations are the same as medullary cancer; that it infiltrates, it supersedes and replaces the natural textures; it repeats itself in the lymphatic glands and lungs; it is often associated with other forms of cancer; it recurs after removal and is often hereditary.

MICROSCOPICAL APPEARANCES. Colloid cancer or carcinoma gelatinosum. In all carcinomata of the gastro-intestinal canal, and sometimes in breast cancers, the epithelia are very prone to undergo colloid degeneration. The fibrous stroma resembles that of scirrhus or medullary cancer. A mucoid or colloid liquid appears first in the protoplasm of the epithelia in the form of clear drops which grow larger and run together. After a time the cell disintegrates and the colloid material is set free. This change sometimes takes place in all the epithelia over a large area, so that nothing is visible except the fibrous stroma forming alveoli which contain a colorless, transparent substance. This substance is often granular and contains, here and there, epithelia which have not yet degenerated. It usually takes the eosin stain.

Other parts of the same tumor may be perfectly free from degeneration.

CARCINOMA-MYXOMATODES. This name is applied to a carcinoma the stroma of which is composed of myxomatous issue. These growths occur in the alimentary canal and the breast.

CARCINOMA CYLINDROMATOSUM. This is a rare form of cancer which presents small rounded areas of hyaline degeneration in the epithelial masses, resembling the sarcomatous "cylindroma" (q. v.) In another form the hyaline degeneration affects the stroma, in which case there are seen long lines or masses of epithelia separated by a hyaline material instead of by fibrous connective tissue.

MELANOSIS—MELANOTIC CANCER. The synonyms of this variety of cancer are "black cancer" and "carcinoma melanodes."

Melanosis is undoubtedly encephaloid or medullary cancer, with a deposit of pigment throughout the substance. The history and symptoms are therefore very similar to those already noticed as belonging to that disease. The colors of this kind of cancer constitute its peculiarities; they are brown, bronze, and even black. In those cases of melanosis which have come under my observation the color was rather a dark plum color, and was interspersed throughout the growth without regularity, and in masses varying in size from a pea to that of a kidney-bean. It is understood that the pigment bears no especial relation to the malignancy of the disease, and that parts of an encephaloid may be entirely free from coloring-matter, while others may be very melanotic.

In primary melanotic cancers the structure is softer than other malignant growths of the same age. They make their appearance as infiltrations, but also may be circumscribed. The peculiarities of melanosis are, besides that of color just noted, according to Paget, their proneness to appear near cutaneous moles, and their profuse multiplication. The color is due to the pigment cells, which are similar to those of the choroid coat, or to those found above the basement membrane of the skin in the colored races. From the similarity which exists between the coloring matter of this form of cancer and that found in the lungs of aged people some have supposed that melanosis is "a pigmental degeneration of cancer." The second and third peculiarities are not well understood, although the last may be more apparent than real, the pigmentary deposit having a tendency to draw out and color many cells which otherwise would be unobservable.

Ganghofner and Pribram* have given especial attention to the character of the urine in patients suffering from melanotic cancer, and find it contains a peculiar substance, chromogen, which varies with the specific gravity, viz., the solid constituents of the urine.

MICROSCOPICAL APPEARANCES. Melano-carcinoma is a carcinoma characterized by the presence of black or brown pigment, like that of melano-sarcoma. It is very rare. The pigment lies partly in the epithelial cells and partly in the fibrous stroma. By some pathologists it is held that tumors which have been described as melano-carcinomata are really melano-sarcomata of the alveolar form. According to Delafield they are usually soft and occur most often in the skin.

Lymphatic Infection.—From what has already been said in the description of breast cancer concerning the invading of the lymph spaces by epithelia it will be readily understood why secondary carcinomata appear so early in the adjacent lymph glands. From the lymph spaces the epithelia enter the lymph-vessels, drift along in the stream, and are filtered out by the first set of lymph glands which lie in their path. Plate

*London Medical Record, January 15th, 1877.

XXXI, Fig. 9, shows a section of a lymph gland of the neck which is being invaded by cells from an epithelioma of the palate. The small, round lymph corpuscles, whose purple nuclei occupy nearly the entire corpuscle, contrast strongly with the broad, pink bodies of the epithelial invaders. The presence of the epithelia will shortly call forth a reaction in the fibrous frame-work of the lymph gland, which will furnish a heavy fibrous stroma. The lymph corpuscles will disappear and the lymph gland will shortly be converted into a typical carcinoma, which is usually of the medullary type.

It will be noticed that the epithelia in the lymph gland have maintained more or less their squamous character and the spindle form which characterized the primary tumor from which they came. This is not always the case in the growth of a cancer. In the developing carcinoma of the breast, as represented in Plate XXXI, the original small columnar epithelia usually enlarge with successive generations until the resulting cancer cell is more than double the size of the original epithelium. On the other hand, the squamous-cells of skin cancer, as mentioned in the paragraph on squamous-celled epithelioma, when they penetrate to a certain depth, often take on the cuboidal character of the cells of acinous cancer; while the epithelia of malignant adenomata often lose their columnar character and become cuboidal.

CHAPTER VIII.

TREATMENT OF MALIGNANT GROWTHS.

General Considerations.—The medical treatment of tumors is very difficult, because in the majority of cases tumors have no symptoms. The author means, of course, to exclude pressure symptoms; even certain forms of carcinoma exist in the system for years without producing any sensation; indeed, it is the author's experience that many cancers are first discovered by accident after having attained considerable growth, the patient being unaware that a neoplasm existed.

In the treatment of certain malignant growths (carcinoma) the first medicine is arsenic. The author's experience in its use has been large, and he has found great good from its administration, but has never known of its being of the slightest service in sarcoma. Its range of action appears to be adapted to both the early and late stages of carcinoma.

Mitchell, of Chicago, has advised not only the internal administration of the drug but also its topical application. This medicine is probably adapted to more cases of cancer than any other; and together with the chloride of zinc is the basis of most all the cancer pastes. It is desired to draw one or two practical conclusions from the use of hydrastis, of thuja, of calcarea and of hemlock, together with the hypodermatic use of nascent phenic acid in the treatment of these affections. In all cases the topical application of the medicine appears materially to assist the internal exhibition of the drug. Mitchell has already proven this with regard to arsenic, and we know that the results from the applications of the varied arsenical pastes are often surprising.

It will be remembered that in the remarkable cure of Field Marshal Radetsky, Hartung* applied the tincture of thuja in water to the fungus, and also a solution of *carbo animalis*, "burnt chops," as it was ironically called by Flaser. It was really from this fact, and the lessons taught by a gradually increasing experience, strengthened finally by the report of Mitchell's cases, that the author arrived at the conclusion that to obtain the fullest effect of medicine upon tumors topical applications are necessary.

As Butlin also has informed us, in order fully to understand the different varieties of sarcoma and carcinoma, those growing in different localities should be studied separately; so it is with the treatment of these neoplasms. It is the author's experience from a clinical study of many cases that arsenic is much better adapted to cancers of the face than to those appearing in any other portions of the body, while hydrastis is better adapted to carcinomas of the cervix uteri. The author cannot agree either with Bayes, who considers this medicine especially effective in scirrhus, having tried it repeatedly without good results though finding

*Being a series of letters which appeared in the *Homeopathische Zeitung*, July, 1841; also *British Journal of Homeopathy*, vol. 1, p. 147.

it most servicable in squamous-celled carcinoma (epithelioma). The author administers the tincture or first dilution internally three times a day, and applies the pure tincture of powdered hydrastis twice during the twenty-four hours to the part. The curative action of Marsden and McLimont's paste, (of which further mention will be made) is very apparent in certain forms of epithelioma, and is due, it is believed, to the presence of the submuriate of hydrastin. The medicine for hard cancer is conium internally, given with the tincture applied either by means of compresses to the part or as a conium plaster, such as now made by Johnson & Johnson, used in the same manner. While arsenic seems adapted better to the face and hydrastis to the cervix conium has an affinity for the female breast, and is especially active in the early stage of the disease. These indications are given from a clinical and pathological standpoint, and during the treatment other intercurrent remedies will always be necessary.

With regard to the medical treatment of sarcoma the author has had more good results from thuja than from all other medicines combined. He cannot be precise enough to say to what variety of sarcoma it is especially applicable, for as a rule the variety can only be determined when the tumor has been taken out of the body, or the patient is dead; but he has had cases of undoubted sarcoma, one beneath the left ear, one on the back of the shoulder, one of the testicle (which ought to be spindle-celled if Butlin's remarks are true), which he has cured with thuja. The conclusions relating to these medicines would not have been reached if the patients had consented to operation; for if the author has a sarcoma, especially in its early stages, he always recommends its immediate extirpation, for the earlier this is done the less likely is the neoplasm to return. In these cases, all of them, the medicine was thuja tablets (a drop of the tincture to the tablet), one of these taken three times a day for ten days; then an interval of two days is allowed to elapse without any medicine, the tablets to be resumed for ten days and this alternating continued for several weeks, or even longer. During all this period the tincture of thuja is brushed plentifully over the growth. The carbolic acid treatment of these tumors (sarcomas) was a long while ago introduced to the profession by Beebe, and has been also used by his brother.

Declat's Method.—This method is used as follows: Inject every three or four days, somewhere in the vicinity of the tumor, 80 minims of Declat's nascent phenic acid, sometimes giving also internally the Declat's syrup of the iodo-phenique. The secret of success in this treatment is persistency. In some cases the author has given from 100 to 200 injections and allowed the treatment to continue over two or three years. He has never known any unpleasant effects to arise when the needle was properly inserted, and the chief inconvenience is the temporary pain occasioned by injecting so large a quantity into the cellular tissue.

Even in cases that have been hopeless, so far as any operation was concerned, the treatment has been known to arrest the rapid progress of the disease and give the patient a much more quiet life.

Use of the Knife.—The question of operation in carcinoma and sarcoma has been so thoroughly discussed that it is not necessary to revert to it here. Every man must form his own opinion in every case.

The author's opinion is that always in the earlier (the earlier the better) stages of both carcinoma and sarcoma the knife should be freely employed, and while he does not approve of the indiscriminate cutting that has been recommended within the past few years, and regarding which so much discussion has taken place, he does say that careful and complete removal of diseased and suspicious masses should be always attempted; nay, further, it is held that a surgical operation should be performed if the patient can be relieved of suffering, even without hope of cure.

Those who reason in the abstract against operative interference in advanced malignant disease cannot be aware of the terrible suffering that continues day after day in these cases, only to be partially smothered by massive doses of morphia, which, by its reactionary effects, only increases the misery of the patient by adding to the already broken-down body many distressing symptoms of gastric and intestinal disturbance. In these times of comparatively painless operating, when a single dressing suffices for many days, when the patient is not disturbed by frequent examinations or distressed with offensive odors, when the gentle manipulation taught by professional nurse-training takes the place of the supposed-to-be-necessary rough handling and brusque manner of the nurses of a quarter of a century ago, surgical operations are deprived of their terror. The traditional horrors of the knife and the surgeon are lost. These moral considerations themselves, often the most forcible arguments urged against the performance of operations, being combated, the patient will often beg to be given the opportunity for relief and the surgeon will be led to acquiesce in the proposal.

From a large experience in the operative surgery of malignant diseases it is safe to say that it is better for the patients to take the chances of death within a day or two than to continue living in pain for a few months with the body loaded with narcotics and painfully dying by inches. It would seem that humanity itself demands surgical interference in such cases.

Medication.—An attempt has here been made to give the clinical experience of some of the best known members of our school in the treatment of malignant diseases, in the hope that it may be of service to those who are called upon to treat these intractable maladies.

Many quotations of cures have been omitted; but it is to be hoped that sufficient facts have been given to prove that in a disease considered beyond the reach of medicine by the old school well-directed homeopathic medicines can and have effected cures, and that when operative interference becomes necessary the beneficial influence of homeopathic after-treatment cannot be denied. It may modify the cachexia, or postpone the recurrence of the disease. It would be ridiculous, however, even with this knowledge, to make the broad assertion that all cases of cancer may be cured, or that return after extirpation is not to be expected. The facts remain that cases are and have been cured, and such facts encourage every surgeon in his endeavor to select the proper homeopathic medicine and to avoid if possible the performance of operations; and still further, if the knife be deemed necessary, or the caustic treatment seem advisable, he has certainly in the homeopathic materia medica an agent which will assist him in preventing recurrence and alleviating suffering.

Hydrocyanate of Potassa. Hughes * reports a most excellent case, quoted from Petroz, in which a woman under the care of Herminier had a suspicious ulcer of the tongue, involving the parts deeply. The doctor, distrusting his own diagnosis, sent her to Mardolin, who returned the following: "Cancerous ulcer; no chance of cure but from operation, and this is impossible, for the base of the tongue is involved." This case, which was probably one of epithelioma, was cured by the hydrocyanate of potassa, 1-100th of a grain at a dose, repeated every fourth day. Eighteen years afterward there had been no relapse.

Belladonna. Stapf † reports a most interesting case of fungus hematodes oculi which was completely cured. Belladonna removed the excessive photophobia and inflammation in six days; calcarea carbonica cleared the cloudiness of the cornea; lycopodium, sepia, and silicia removed the fungous growth. The cure was complete.

Muhlenbein‡ gives also a case of the same disease, so diagnosed by several allopathic physicians and an experienced surgeon, in which belladonna, one drop at intervals of a week for four weeks, together with nuxvomica, euphrasia, and aconite, completed the cure.

Bryonia. Von Veitunghoff, || among his cases, has recorded one of encephaloid of the breast which is interesting. The pain was relieved by belladonna and bryonia in alternation; phosphorus and hepar, also in alternation, materially improved the character of the discharge; arsenic caused suppuration and discharge of the tumor. After persevering with the latter for several months the cure was perfected.

Other cases of this variety (encephaloid) of cancer are found throughout our literature. §

Pease,** in a short and practical paper on "Cancer," mentioned three cases, in two of which operations had been performed, cured with the carbolic acid treatment; one was alive five years, the other four years after operations had been performed. The third, however, a case of hematoid cancer, located on the right cheek, and extending to the ala of the nose, was cured by carbolic acid internally and externally with no return in three years.

Carbolic acid. Beebe†† gives a case of melanotic cancer cured chiefly by carbolic acid and sanguinaria, the former for the specific disease, the latter for gastric disorders. During the first three weeks of treatment the tumor was reduced to the size of a pin's head, and all suffering relieved. Ultimately there was complete recovery.

Arsenicum. Leon‡‡ relates a case of carcinoma uteri which had not recurred after three years. The medicines were arsenic, a dose night and morning for one week; conium 3x night and morning for one week. These medicines were continued four months in alternation, with an occasional dose of china as an intercurrent for hemorrhage.

*Therapeutics, p. 219.

†Archiv für die Homeopathische Heilkunst, vol. 7.

‡Loc. cit. (both these cases are recorded in Jeanes' Homeopathic Practice.)

§British Journal of Homeopathy, Vol. XVII, p. 53.

¶British Journal of Homeopathy, Vol. XXVI, p. 658. Quinn's case in the Annals, Vol. I, p. 177-795.

**Transactions of the American Institute of Homeopathy, 1872, p. 390.

††Medical Investigator, Vol. XI, p. 549.

‡‡United States Journal of Homeopathy, Vol. I, p. 41.

Hydrastis. Bayes' essays,* written especially with reference to the use of *hydrastis canadensis* in the treatment of cancer, will repay perusal. He also includes in these statistics Bradshaw's† cases, offering additional testimony to the beneficial effect of the "Golden Seal."

Galium. *Galium aperium* has been known for some time to exercise a powerful influence upon certain cutaneous diseases, and also to possess some curative virtue in cancer and nodulated tumors of the mouth and tongue. Cases are upon record where it has certainly proven of great efficacy. Balley, F. R. S. C., records a case in which a cure was apparently effected. The preparation used was—

Extract. Galii aperini solidi. ʒ ij
Aque Oss.

M. ft. extract. fluid.

Of this a drachm and a half were given twice a day in a wine-glassful of water, and as a warm lotion applied to the parts several times during the day.

Phytolacca. *Phytolacca* appears to have some influence on cancer and scirrhus of the breast. Not long since there was a good deal written concerning the action of acetic acid upon cancer-cells, and Bence reported a very interesting case of cancer of the breast, treated by Thompson at the University College Hospital, with the examination of the morbid specimen. The method of treatment was first suggested and employed by Broadbent.

Hastings also has employed the treatment successfully in cancer of the liver, stomach and mammae. The acid was given in the latter case in three-drop doses three times a day, after which an interval of two days was allowed to elapse and the medicine resumed. A compress saturated with acetic acid solution was worn over the breast. This case was apparently cured.

The author has tried this method and also injected the tumor with the acid, but is forced to say that he has derived no positive benefit from its use.

Cedron. This remedy was introduced to the author's notice by Kellogg, of New York, who had used it successfully as a palliative to the severe sufferings, especially the lancinating pains in the advanced stages of cancer. Drop doses of the tincture frequently repeated are necessary to produce relief.

Lapis albus. This medicine, introduced by Grauvogl, was kept secret for a while by him in order to prove to Liebig that the power of medicines might be ascertained, and the position of the science secured, without in all cases the aid of chemistry. This substance is the white primitive calcium gneiss found in the lower Ache valley, abounding in the mineral springs of Gastein. The cures said to have been made by this drug are remarkable. It was given in the first to the sixth decimal trituration.

Resorcin. This medicine has been highly extolled by Gatchkovsky‡ as an application to "cancer-like" growths. It is applied either in substance or in the shape of a fifty per cent. vaseline ointment. When used

* *Hydrastis can.* in *Cancer*. B. J., Vol. XIX.: also loc. cit., Vol. XX., p. 1.

† A Few Remarks on *Hydrastis*. B. J. H., 1861, Vol. XVIII., p. 598.

‡ The Medical Record, August 8th, 1894.

in powder the remedy was dusted freely over the part, and the ointment was applied twice a day. The cases recorded are of interest.

ENUCLEATION. The system of enucleation was first introduced by Justamond, an English surgeon of the last century, who employed an arsenical paste. The pastes generally used consist mainly of arsenic and chloride of zinc.

Marsden and MacLimont employ the following preparation and the author finds it of much service:

Zinc. chlor.....
Hydrast. submur.....
Ung. stram. aa 3 ij.

M. ft. ung.—Use externally for three hours.

They claim for this mode of treatment the following advantages: That it obviates all danger of pyemia, “the chloride of zinc acting as an antiseptic;” that it produces no constitutional disturbance; that it is equally applicable to all forms of malignant growths, and may be employed when the use of the knife is inadmissible; and that “it gives rise to such drawing or contraction as to bring within reach of the paste portions somewhat deeply imbedded in the surrounding tissues.”

Pattison,* of London, employs an enucleating paste composed of equal parts of powdered hydrastis root, chloride of zinc, flour and water. The method of application is the same as that already described. This treatment gives rise to slight constitutional symptoms, which are met by the appropriate remedies.

Michel’s process for removing external tumors, for a knowledge of which Bell paid 25,000 francs, was made public by the latter in a spirit of true liberality. It is worthy of consideration, and can be found in *The Practitioner*, June, 1871, p. 377.

Broadbent recommends injections of the first dilution of acetic acid. The pain is slight, and hemorrhage is checked by the use of styptics.

Routh, of the “Samaritan Hospital,” London, reports two cases of scirrhus cured by the topical application of bromine.

Morgan, of Philadelphia, has cured a case of epithelioma of the lower lip by local application of carbolic acid.

Arnott has advised continued application of cold by means of some freezing mixture applied to the surface of the tumor. This may check the growth for a time, but can never effect a radical cure. The same may be said of Young’s treatment by compression.

Neftel reports that he has used electrolysis successfully in cases of hard tumor. From his experiments he is inclined to believe that this treatment exerts a positive beneficial influence upon the cancerous diathesis.

The iodide of arsenic has been partially proved, and from the symptoms it has produced and from certain cases in which it has been productive of great benefit, is highly recommended, as has been also the phosphate of iron. The latter is said to have produced “the most happy results;” by its administration the pain is lessened and the ulcer takes on a more healthy appearance.

The power of arsenic as a prophylactic after these operations is very highly spoken of by the celebrated ovariologist, Atlee, of Philadelphia.

* *Vide* Pattison on Tumors.

At a meeting of the American Medical Association, held in Philadelphia in May, 1872, the subject of cancer being under discussion, he made the following remarks:

“My experience with arsenic is unusually large and each year has increased my confidence in it. I have now patients in the city—and if it had occurred to me I could have brought you four or five—whose breasts have been amputated from five to twenty-five years, and who are examples of the protective power of arsenic and of its extinguishment of the cancer-cell.”

TOXINES. The treatment of cancer with the toxins of erysipelas and the bacillus prodigiosus, which has attracted considerable attention, cannot as yet be spoken of with any certainty. The matter is sub judice, and although Coley has given some statistics which appear very favorable to the method a sufficient number of experiments have not yet been made to strongly recommend the treatment. It is said that these toxins have more power over sarcoma than over carcinoma, and that the actions of the toxins of the erysipelas streptococcus is greatly increased by the addition of the toxins of the bacillus prodigiosus.

Mode of Death.—Cancer patients die in many cases because their systems are actually poisoned, the blood becomes scanty, the organs break down, the secretions alter. The entire lymphatic system appears to be filled with the poison, which often manifests itself in many parts of the body at the same time. Those individuals who possess a strong constitution give greater resistance, of course, although this may not always be the case. The author has known patients who have been suffering from other diseases offer more resistance to the inroads of cancer than those who to all appearances were much more robust.

Cancer patients also die indirectly from the poison; some are carried off with effusions, and some with pyemia. Again, cancers entirely obstruct the bowels, cancers eat out the esophagus, cancers destroy the air-passages, cancers tear open arteries, cancers perforate the organs, in fact, deaths from cancers are effected in all parts of the body and in many ways and, unfortunately, medicines are not of much avail against their inroads.

CHAPTER IX.

CYSTIC TUMORS.

Distinctive Considerations.—According to some authors every dilatation of any organ or tube in the body is tabulated as a cystic tumor. This wide classification, however, would be inappropriate in a work of this character, because it would necessarily include very many surgical as well as medical diseases. Hydrometra, hydrosalpinx, hydronephrosis, hydrocephalus, cystic testicle, cholecysts, hydrocele and even appendicitis would be included in the list. The more simple arrangement of classifying these growths by their contents will be followed, and thus the vast catalogue reduced to a few.

Speaking precisely, cysts ought not properly to be classed as tumors. If they are they should be placed under the head of the adenomata, because they so frequently develop from glandular substance. Cysts are formed and grow, first, from a retention of the normal secretion of a gland, caused by a stoppage of the excretory duct, or, second, by the preternatural secretion of a gland, which is not provided with a duct, or, third, by the rupture of a blood vessel into a gland thus distended. In the first instance, we might have a sebaceous cyst; in the second, a bursa; in the third, a sanguineous cyst would be produced. Then, again, we find cysts, and hundreds of them, independently, produced by the formation of a cyst wall around an accumulation of blood, or a parasite (as echinococcus), which, indeed, cannot be properly classified as a cyst, or by the softening or liquefaction of tissues from mucoid or fatty degeneration. There are also cysts that are formed from the divergence or expansion of the spaces of connective tissue (hygroma).

Cysts are, therefore, sacs, with walls of widely different texture, and with their contents varying greatly. They may, in their many forms, occur in every portion of the body. The author has often seen them and in almost every organ in the cavity of the abdomen. Many have been found in the same patient, varying in size from that of a pea to a diameter of four and a half inches. There is a remarkable case upon record* in which the liver, spleen, mesentery and omentum were studded with cystic tumors. Large cysts were found in the bladder and sigmoid flexure of the colon, and were distributed everywhere. They could, indeed, be counted by thousands. This was a true case of *tenia echinococcus*, which, by some authors, would be excluded from the classification as cysts.

Diagnosis.—As a general rule there is no special difficulty in diagnosing cystic tumors; the chief symptoms which lead to their detection are fluctuation and a smooth oval surface, with absence of pain and with a healthy integument, which, however, may assume a bluish appearance from tension if the tumor be large. The diseases with which they are most likely to be confounded are cold (or, as they may be termed, subacute) abscesses. Fluctuation is perfectly apparent in both cases and

* Western Homeopathic Observer, Vol. III., pp. 154-162.
(1265)

there is no very high degree of inflammation manifested in either. The history of the case may be of great service and the manner of growth of the tumor also assists; there is a great degree of inflammation in the abscess, and its apparent pointing will be a guide to the surgeon; but where the tumors are covered by layers of dense muscles it is almost an impossibility to recognize the cyst and, at best, only the general conditions can be relied upon in the diagnosis. The question here arises with the present understanding of the formation of cysts, whether an *abcès froid* is not a true cyst itself.

Classification.—Cysts may be primitive vesicles and form singly, attaining in some instances great magnitude, and in others varying from the size of a millet-seed to that of a walnut. Billroth in his classification places the cyst among those “tumors which seldom return after their extirpation, but sometimes occur distributed in great numbers over the whole surface of the body.” He then subdivides them according to the contents of the sac, thus:

a. Cysts with serous fluid; found in the spermatic cord and also found in the neck.

b. Cysts with mucous contents (colloid), which contain a soft, gelatinous substance or mucous tissue; they are discovered in the neck, in the ovary, and in the thyroid gland; they may be very numerous.

c. Cysts with a pultaceous or fatty matter; these occur in great numbers, often in connection with sebaceous glands or hair-follicles. He says that their walls sometimes present a cutis-like construction on their internal surface; a rete Malpighii, hairs, and sebaceous and sudoriferous glands (dermoid cysts). These cysts, when found in the ovary, sometimes contain pieces of bone, teeth, hair and the like and are known as “dermoid.”

Among the simple cysts are (a), those containing serum, mucus, and other substances; (b), the transition cysts, containing synovia, milk, semen or the like; while (c), the proliferous cysts, contain still more highly organized structures.

Cysts may also contain gas; such are denominated “gaseous cysts.” Again, in some instances, cysts in the neck appear to be a transformation of erectile or vascular tumors.

All varieties of cystic tumor have come under the author’s observation, and from the lessons which the cases have taught he would lay down the general rule that the simplest and safest method of dealing with them is to extirpate the sac by dissection. The treatment by puncture and injection is unsatisfactory, and should only be tried when excision cannot be performed.

Cysts from Expansion of Spaces in Connective Tissue.—The neck appears to be the seat of many simple serous tumors, called hydrocele of the neck, or hygroma.

It sometimes happens that these cysts exist for years, and often contain a bloody serum and sometimes pure blood. They are sometimes very difficult to manage. The cyst wall is composed of a thin membrane which dips down between the muscles and requires minute dissection to completely remove it. Tapping the cyst is not effectual as the fluid is likely to re-accumulate. Tapping, injection with iodine, and drainage have given the best results. There may be some difficulty in retaining the drainage tube, as not only is it liable to slip out, but it may pass within the



Figure 1. Enormous Fibroma Springing from Parotid.



Figure 2. Cavernous Angioma of Dura Mater Perforating the Skull.—Helmuth.

cyst and give great trouble. It should be carefully secured with a safety pin of large size.

Sanguineous Cysts.—The “hematomata” of Bennett and other writers are nearly related to serous cysts. According to Paget they may be formed in three different ways, either by hemorrhage into a previously existing serous cyst; by partial obliteration and transformation of a nevus; or by the occlusion and dilatation of a vein. These tumors occur most frequently in the neck, and contain a bloody fluid. The cyst-wall varies in thickness, according to locality. In subcutaneous cysts it is membranous, and presents a columnar or fasciculated appearance, due to the unequal rupture of the membrane.

Sometimes a blood vessel opens into a sero-cystic tumor and forms a sero-sanguineous cyst, which is described by some writers as a separate variety of cystic growth. Paget, however, makes no such distinction; on the contrary, he expressly states that a sanguineous cyst may be formed by “accidental hemorrhage into the cavity of a serous cyst.”* It is therefore preferred to regard it as a mere subdivision of the preceding variety.

Congenital Cutaneous Cysts.—These are sometimes found on the foreheads of infants soon after birth. They are round, flat or oval; the cyst-wall consists of “membranous connective tissue, lined with tessellated epithelium,” and contains an oily fluid. These tumors may also occur in other parts of the body. They are evidently synonymous with the variety described by Paget as oily cysts.

Congenital Serous Cysts of the Orbit.†—Congenital serous cysts of the orbit are said by Talko, from his observation of six cases, to be situated between the eyeball and the lateral wall of the orbit; to be commonly covered with conjunctiva, to increase in the direction of the lower lid, causing ectropion, to vary in size, and prevent the development of the eye, producing microphthalmus. They contain a yellow serous fluid, rich in albumin, and are not formed after birth. They are not usually intimately united with either the conjunctival fold or eyeball, and should be extirpated.

Synovial Cysts.—We may distinguish two varieties, those formed by the enlargement and transformation of bursæ, and those which occur in the sheaths of tendons, and which “appear to be the cystic transformation of the cells, inclosed in the fringe-like processes of the synovial membrane of the sheaths.” (Paget.) The cyst-wall may consist of a thin membranous expansion, or it may be thick, fibrous, and lined with a pasty-looking laminated growth of imperfectly organized fibrin. The contained fluid is serous, and of a yellowish or brownish color. Attached to the walls and floating in this fluid are sometimes found small grayish or yellowish granular bodies, irregular in shape, and closely resembling granulation-cells (melon seed bursæ). These often exist in such numbers as to completely fill the cyst, and convert it into a solid mass. These tumors often show a tendency to inflame and suppurate.

Mucous or Myxomatous Cysts.—Under this head may be included all cysts found in mucous tissue. They occur in various parts of the body, but attack most frequently the female sexual organs. They

* Paget's Surgical Pathology.

† London Medical Record, July 15th, 1877; Monthly Abstract of Med. Science, September, 1877.

grow either singly or in clusters, and are generally oval. The cyst-wall is sometimes thin and membranous, in other cases thick and tough; the contents vary greatly; generally they consist of a transparent or opaline viscid fluid; at other times this fluid is dark, turbid, greenish or nearly black. Hawkins relates a case in which it closely resembled fluid feces. By microscopical analysis it is found to contain corpuscles, granular molecular matter, and cells. (See also "Ranula.")

Colloid Cysts.—The term "colloid" is applied to those cysts which contain gelatinous substances; the contents may range between pellucidity and the thickest turbidness, and may be of all hues of yellow, olive-green, orange, brown, pink and nearly black. These cysts occur in the thyroid gland (Fig. 800 represents a large thyroid cyst; the patient was a roadside beggar in Switzerland and the photograph was taken for the author by Terry) and the kidneys, and, according to Tobold, are occasionally found in the larynx.



Fig. 800.
Thyroid Cyst.
—Terry.

Formation of Colloid.—Colloid material is nearly allied to protein substances and mainly consists in the albuminous transformation of tissues varying much in consistency, sometimes being about the density of egg albumin and again presenting an almost solid appearance. These altered albuminates sometimes contain a certain proportion of mucin, a substance insoluble in acetic acid and soluble in alkalis, although as a rule this latter ingredient is absent in the colloid of ovarian cystoma. These myxomatous products arise not so much from a true metamorphosis of tissue as from a modified secretion from or transformation of epithelial elements. In the young cyst the colloid material is more dense than in the larger and older ones, the fact being explained by some* as resulting "in a slow digestion of these crude substances" by the prolonged and constant action of the heat of the body.

It must be remembered that there is both an innocent and a malignant colloid material found in these cysts and which it is important to understand. The author believes that a broad line cannot be drawn between the two, as myxomatous or mucoid formations are composed generally of imperfectly formed cells which, instead of proceeding to a perfect and mature development, assume a retrograde metamorphosis, resembling in many respects the appearances presented by cancerous structures.

This is proven by the fact that after an apparently successful ovariectomy carcinomatous formations may speedily destroy life. The author has had occasion to observe this in several cases. In one infiltration and cachexia commenced before the abdominal wound had entirely cicatrized; in



Fig. 801.
Colloid Cyst.—Helmoth.

* Peaslee, Ovarian Tumors, p. 33.

another there was a large ascitical accumulation, the patient returned home apparently cured, but in eleven months re-entered the hospital with a well developed cancer of the omentum with large colloid accumulation. She was aged forty-seven, and had given birth to one child. According to Beyer, whose paper Heitzmann* gives in full, colloid cancer is not to be classed as a separate species, but as arising from secondary changes in the encephaloid or medullary cancer. He says: "In the same manner as cancer elements arise from medullary elements so may fully developed epithelia under certain unknown conditions retrogress to medullary elements. Whenever this occurs medullary corpuscles are transformed into a reticulum containing a jelly-like, homogeneous basis-substance, with interspersed remnants of epithelia."

And again Pepper says: † "Colloid cancer is built upon the same structural type as scirrhus and encephaloid. It bears a close resemblance to the latter in its clinical features, being rapid in growth and quickly fatal. The consistency of these tumors is subject to wide variations, but for the most part they are very soft, sometimes diffuent. When springing from the ovaries they may be mistaken for simple cystic formations. The degeneration commences in the cells; first a drop appears in the protoplasm, and as it enlarges the nucleus is thrust into the margin. Finally nuclei and cell capsules disappear, the change advances from the centre to the periphery, and the outside cells, prior to their destruction, become compressed and elongated and occupy a concentric position. The stroma undergoes a similar alteration, it softens and liquefies, so that the contiguous alveoli run together, forming festooned cavities."

Dermoid Cysts.—There have been many theories propagated regarding the origin of dermoid cysts, some, indeed, at the present regarding them as fetal remains (fetus in fetu), or ovarian pregnancy. These conclusions have been proved erroneous. The argument against such hypotheses is the appearance of bone, hair, teeth, lime, etc., in other portions of the body and in both sexes. The majority of the profession appear to agree as to the congenital origin of these cysts. Waldeyer's views are generally accepted, although founded on no very recent experiments. He is of opinion that these tumors arise from the epithelial cells of the ovary, each of which is capable of becoming an ovular cell, and by some morbid process proceeding to incomplete embryonic development.

Now it may very well be assumed that the epithelial cells of the ovary, in conformity with their significance of undeveloped ovular cells, furnish in their multiplication or division, and by budding, other products, and in fact such as are further advanced in the direction of an incomplete embryonic development than they themselves are. (Emmet.)‡

Tait supposes that during the developmental period of life a stimulus is given to a Graafian vesicle with its ovum, which, if it were not disturbed, might in time be carried into the uterus and there impregnated. On the contrary, if it remain in the ovisac and there "share alike with the rest of the economy in developmental activity there could be only one result, and that would be the formation, in an incomplete degree, of those

* Medical Gazette, New York, April, 1880; Microscopical Morphology, p. 551.

† Elements of Surgical Pathology, London, p. 482.

‡ Emmet, Gynecology, p. 767.

structures which it would evolve in perfection under more favorable conditions."*

In the author's opinion the best solution of the question is that of the invagination of the blastodermic membrane, the external layer of which develops the organs of animal life. If, therefore, there should be an enclosure of any part of this membrane within any organ of the body these epidermal formations would readily be produced.

In this variety the wall is thickened and consists of two layers. The author has seen a cyst that could be separated into six laminae. The older the cyst-wall becomes the more are these concentric layers of deposit arranged within it.

There are fat-globules and masses of fat on this layer, which may be mistaken when opening the cavity for the appendices epiploicae of the omentum.

The inner layer is skin, in which some observers have found not only the ordinary sebaceous glands, but also hair-follicles and sweat-glands. This skin presents the anatomical formation of the derma and has often the papillary body and the corium well developed. The contents of the cysts are various—hair, bones of various and peculiar conformation, teeth, fatty or cheesy (*vernix caseosa*) matters, lime and cholesterin crystals.

The author has seen several such tumors. One, in a patient aged twenty-seven years, weighed in all forty-three pounds, twenty pounds of which were contained in one large cyst, opening into which was a smaller one, twelve inches in circumference, filled with sebaceous matter, hair and lime; in another cyst were dark hair, bones and teeth, and in one sac was a bone resembling the superior maxilla, containing perfectly formed teeth, with various other pieces of curiously formed bones.

In another case there was some doubt as to the true nature of the tumor, but it proved to be a dermoid cyst, containing fourteen pounds of sebaceous material, first coming out like bullets and then having to be scooped out with the hands. The substance was actually packed together and was intermixed with a quantity of long, dark hair.

The last variety of simple cysts is that formed by the inclosure and dilatation of a duct and the transformation of its contents. Under this head may be included "milk tumor," "seminal cysts" or "encysted hydrocele of the cord," parovarian and some forms of ranula. The walls are generally composed of "fibrous tissue lined with tessellated epithelium."

The contents are either a serous fluid or the natural secretion of the part; for example, seminal cysts may contain either semen or spermatozoa. In the latter case the cyst seems to acquire a secreting power of its own, for it is entirely unconnected with the proper secretory apparatus.

Compound or Proliferous Cysts.—These have been already defined as those "which contain highly organized and even vascular structures."

Cysto-sarcoma.—This is a peculiar disease and has given rise to considerable discussion among pathologists. It consists, however, in cyst-formation developed in different or heterologous parenchyma, and

* Tait, Diseases of the Ovaries, p. 180.

is said to occur much more frequently in females than in males. The mammary gland is peculiarly liable to be attacked by it, although it may occur in bone, within the medullary canal, or in the compact structure.

According to Müller, three varieties are found, which he describes thus:

First. **CYSTO-SARCOMA SIMPLEX**, in which the cradle mass does not intrude at all into the cavity of the cyst, is of the rarest occurrence.

Second. **CYSTO-SARCOMA PROLIFERUM** is engendered by the development within the terminal excrescence bulbs of the acinus-like cavities into the filial cysts, and the intergrowing of the cradle mass is here repeated.

Third. **THE CYSTO-SARCOMA PHYLLODES** of Müller, with its amply developed, warty, cauliflower and foliated or cock's-comb-like ingrowths, has nothing to mark it beyond the size and development of excrescences. The cyst-membrane is here no longer demonstrable, having coalesced with the cradle mass of the cyst.

Hydatid Tumors.—These are composed of cysts containing entozoa of hydatids. The cyst-wall is strong, composed of fibrous tissue, possesses considerable vascularity and contains a dirty-looking pulpy sub-

stance, in which the parasite is found. The hydatid itself contains a limpid saline fluid, odorless and incoagulable. These entozoa “perish in a few years from suppuration, gangrene, or gradual drying up of their contents. Under such circumstances the inclosing cyst is often remark-

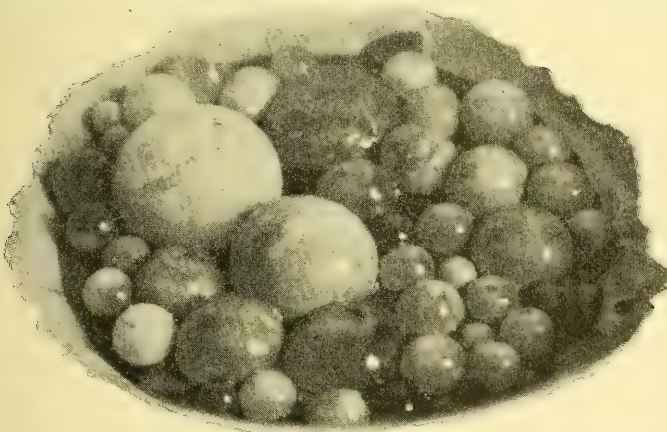


Fig. 802.

Hydatid Tumors of Thigh.—Shears.

ably thickened and even transformed into fibrous tissue.”* These tumors vary in size “from a mustard seed to a small orange;” (Fig. 802) are globular in shape and of a whitish color. They generally occur in the liver, uterus and ovaries, and are occasionally found in the testicles, mammae and serous cavities. By the irritation of their presence they sometimes produce fatal inflammation.

Hydatid tumors may also occur in the cancellated tissue of bones. When existing near articular extremities they may cause destruction of the joints, giving rise to intense pain and often inducing hectic fever. A rare case occurring in the practice of Shears, of Chicago, (Fig. 802) simulated femoral herina.

Retention Cysts.—Sebaceous cysts have been variously described by different authors, as encysted, atheromatous, melicerous and steatomatous

* Gross's Surgery, Vol. I., p. 232.

tumors; when situated on the scalp they are generally known as wens. Most surgical writers hold, with Cooper, that these cysts are composed of enlarged and obstructed sebaceous follicles; but Paget claims that in many cases they are essentially new formations. They occur most frequently on the scalp, face and neck, are generally subcutaneous, and may be either single or multiple. In many instances they seem to be hereditary. The cyst-wall may be thin and delicate, or thick, tough, fibrous and even calcified; the contents usually consist of a semi-liquid, yellowish-white substance, which, in old cysts, is hard, dry, laminated and of a brown, green, or blackish color. Examined under the microscope they are found to contain epithelial scales, granular matter, crystals of cholesterin and rudimentary hairs.

When small they are round, smooth, non-adherent, semi-fluctuating or elastic, grow slowly, and are painless. As they increase in size they adhere to surrounding tissues and show a tendency to become pedunculated. Encysted tumors of the scalp, when fully developed, may induce inflammatory action in the pericranium, causing adhesive and cartilaginous degeneration of that portion of the pericranium lying next the sac. In rare cases the tumor may cause absorption of the outer table of the skull, forming "a cup-shaped cavity, with rough, slightly elevated edges." In some instances the cysts inflame and suppurate; the skin adheres, ulcerates, and the tumor is either thrown off in the discharges or "the sebaceous matter, exposed by the ulceration of the integument, undergoes a process of putrefaction. In other cases, again, large granulations are thrown out in it; the atheromatous mass appears to vascularize, becoming irregular and nodulated, rising up in tuberous growths, with everted edges, exuding a fetid discharge, becoming adherent to subjacent parts, and assuming a semi-malignant appearance." (Erichsen.)

Treatment.—Homeopathic remedies sometimes prove successful in removing the different varieties of cysts.

The author has seen great advantage derived from the internal administration of kali bromatum, given in two-grain doses three times a day.

Calcarea carbonica is recommended by Dunham for encysted tumors of the head and neck, with fluid or semi-fluid contents.

Apis, arsenicum, graphites, hepar, iodum, kali bichromicum, lycopodium, mercurius, phosphorus, silicia and sulphur may be tried.

Electrolysis is also recommended by various authors, and may prove useful in some cases.

A seton may occasionally be efficacious, and in a few instances a radical cure has been effected by subcutaneous puncture and evacuation.

The cysts may also be punctured and injected with a strong solution of iodine, sulphate of zinc, or some other irritating substance, to produce adhesive inflammation.

Pattison reports several brilliant cures by enucleation; he cuts down upon the cyst, evacuates its contents, and fills the cavity with cotton-wool, smeared with an enucleating paste composed of equal parts of powdered hydrastis root, chloride of zinc, flour and water.

If these various methods fail the only resource is complete extirpation, both of the tumor and the wall of the cyst. Great care must be taken to remove the cyst-wall entire, for if the slightest trace of it be suffered to remain the cyst may probably be reproduced.

Teratoma.—By this term is understood a portion of the body, or certain tissues thereof, attached to or apparently growing from or into a normal individual. Strictly speaking, this condition does not come under the head of tumors, but as such malformations are sometimes classified as dermoids brief mention is necessary. Some remarkable monstrosities of this kind are found on exhibition in the cheap museums in the large cities, and some very peculiar specimens are preserved in the cabinets of the medical colleges.

Teratoma are produced by the coalescing of two embryos, one sometimes going on to complete development, while the other is arrested and only forms but a portion of the human body. Two-headed animals, or those having supernumerary legs are not very infrequent. Conjoined twins result from a single ovum giving origin to two embryos. If two embryos should be joined together, one going on to complete development and the other being arrested, a parasitic fetus results; the full grown child is called an autosite. For further consideration of the subject the student may refer to works on dichotomy.

SECTION XXVII.
SURGERY OF UTERUS, TUBES AND OVARIES.

CHAPTER I.
FIBRO-MYOMATA OF THE UTERUS.

General Considerations.—These growths are rarely observed before the age of puberty. They are active during the period of menstrual life, and develop with greatest rapidity just before and during the climacteric. After the menopause, in a great number of cases they cease to grow or decrease in size to such an extent as to cause no further trouble. The more nearly they are composed of fibrinous elements the more dense is their structure, the slower their growth, and the greater their tendency to multiple development. Not infrequently from four to eight hard outgrowths are observed on a single uterus, and in rare cases a score or more are seen. They are hard and unyielding, and often go by the term of hard or red fibroids. When the muscular structure greatly predominates the tumor grows more rapidly, it is edematous, and of a sky-blue color. It is often soft and fluctuating and may be taken for an ovarian cyst, even after the abdomen is opened. These tumors in which the muscular elements predominate are often called soft or white fibroids. Whatever the physical characteristics of the tumors may be the fibroid and muscular elements are always present, and a better name than any of the others is fibro-myoma. (Fig. 803.)



Fig. 803.
Large Myoma.

Although they usually develop in the substance of the uterine wall, they tend to grow inward or outward, and often present under the mucosa or peritoneal covering of the uterus. When the tumor grows from beneath the endometrium, in the walls of the uterus, or projects from under the peritoneum, it is termed submucous, (Fig. 805) intramural, or subperitoneal, respectively. When they break down into one or more cavities they are known as fibro-cystic growths.

The most common site for the development of these tumors is the posterior surface of the uterus, but they may spring from any part of the organ and grow in any direction. Frequently the fundus is involved by a fibroid mass and a secondary growth arises from it, so as to form the

characteristic dumb-bell tumor (Plate XXXVIII). In some cases, they take up the whole substance of the body of the uterus in a more or less symmetrical mass, and, very rarely, as they ascend out of the pelvis, the cervix is attenuated and elongated to such a degree that the growth appears like a non-adherent ovarian tumor with a long pedicle.

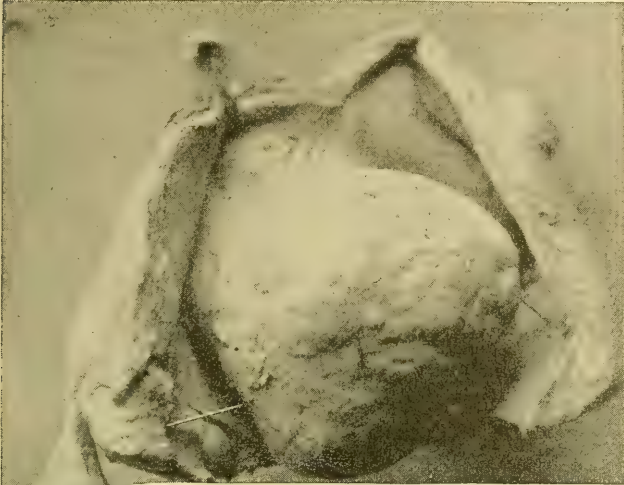


Fig. 804.

Large Fibroid at Dome of Uterus.—Runnels.

placed to the right or left, or even distended upward to a point as high as the umbilicus, where it is adherent, and the patient finds herself unable to empty it without pressure of the hand upon the abdomen.

If a ureter is sufficiently pressed upon there will be hydronephrosis, with its attendant dilatation of the ureter and structural changes of the kidney, or there may be obstruction of the bowels from adhesions, pressure, or both.

When there are one or more outgrowths from the lower segment of the uterus the pelvis may be completely filled, and the condition is even more serious than in the case of growths which fill the entire abdomen. The neoplasms between the mucous membrane below and the peritoneum above expand in every direction, and they are more apt to produce obstruction of the bowels and derangement of the bladder and ureters than large tumors situated above the peritoneum of the pelvic floor. Then if the growth be submucous or intramural, especially the former, it may cause hemorrhage, or slough and carry the patient away by sepsis. When pregnancy takes place the patient runs the risk of dangerous hemorrhage during gestation or the puerperim, or the tumor may break down and terminate life from puerperal peritonitis.

As a result of these conditions the patient's strength not only gives way but the nervous system is often involved to such a degree that from this cause alone, if from none of the others, the patient is incapacitated for any occupation whatever.

Again, the results may be more favorable. Expulsive uterine pains may force the tumor downward, even out of the uterus, and give it a

The pressure-symptoms are usually of great annoyance and sometimes prove fatal. When the tumor is very large it may make troublesome or dangerous pressure upon the liver, the stomach and the diaphragm, as well as the bladder, rectum or ureters. As a result of this pressure and traction upward the bladder may be found very much distorted, dis-

long pedicle, or develop what is known as a fibroid polypus. A similar outgrowth from the cervix is known as a fibroid polypus of the cervix.

One of the most alarming conditions the surgeon meets as a complication of pregnancy is the presence of a fibro-myoma in the lower segment of the uterus, so situated as to completely block up the outlet to the pelvis, (Plates XXXIX and XL) or to find the retroflexed and adherent fibro-myomatous uterus rapidly expanding from pregnancy, which always gives a new impetus to the growth of the tumors. The pressure symptoms from this remarkably rapid uterine enlargement are unbearable, and compel the unfortunate one to seek surgical advice. (Plate XLI). In still another class of cases, and in by far the greater number, the fibro-myomatous uteri ascend out of the pelvis, and the patients, if not relieved, die from exhaustion, due to pressure and loss of function, or during or shortly after parturition.

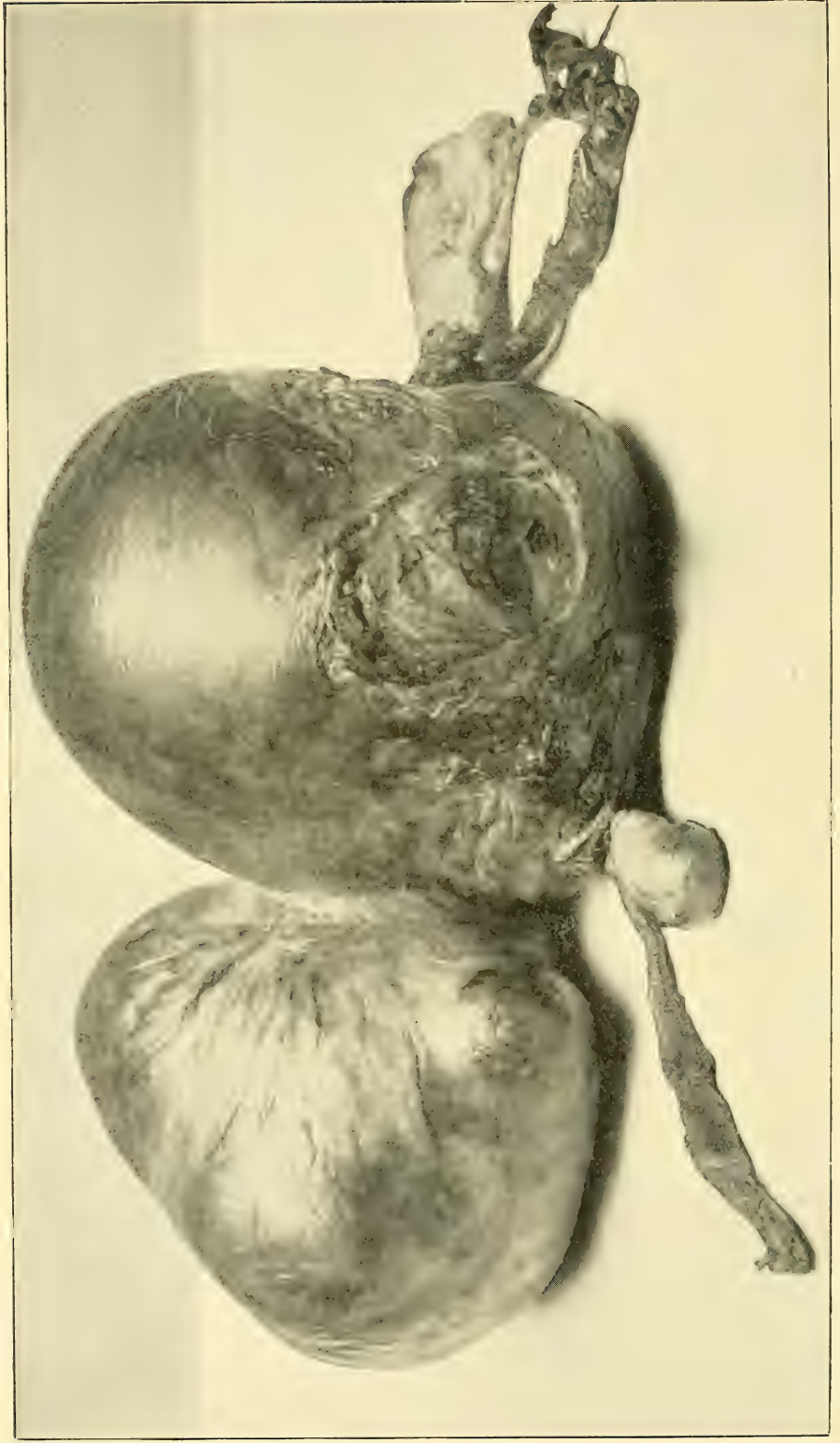
It is a common thing to find the tubes and ovaries diseased as complications of fibro-myomata. Cystoma, hydrosalpinx, hematosalpinx and pyosalpinx are frequently observed, and occasionally pus finds its way into the pelvis, resulting in an abscess. Obstruction of the bowels, either from pressure or adhesive bands, as well as suppuration and even malignant degeneration of the growths, are occasionally encountered.

Symptoms.—In many cases the growth of these tumors is very slow, no symptoms at all are observed, and the first intimation the patient has of their existence is the presence of a hard tumor in the abdomen. In other cases, from the situation of the tumor or its rapid growth, there are pressure-symptoms of a wide range of variation and of more or less severity. If the urethra, the bladder, the ureter, or the rectum is encroached upon there may be difficult, painful or frequent urination, constipation or hydronephrosis. Pressure upon the nerves causes excruciating pain which streaks down the thighs, and from impeded blood return dangerous passive congestion develops, and the legs and thighs become enormously swollen from edema.

The menstrual periods last from one to three weeks, or the flow is continuous. In other cases there may be only a bloody or watery uterine discharge, or a dangerous metrorrhagia develops.

Diagnosis.—On bimanual examination of the pelvic contents the tumor is usually found centrally located, hard to the touch, and the uterus moves with the change of position of the growth. The neoplasm may be pyriform in shape, twice the size of the normal organ or it may fill the entire abdomen. In other cases there are two or three lobes, or the organ is completely studded with neoplastic formations. The principal tumor sometimes grows from the lower segment of the uterus, while smaller ones spring from the fundus. A mass may completely fill the pelvic outlet and press upon the rectum, ureter or urethra so as to seriously embarrass the functions of these organs, while the cervix is drawn up even out of reach of the finger. When the os is finally palpated it may be found open, giving the sensation of a slit in the softened cervix. Or, if the growth springs from the fundus the cervix and os may appear quite normal. When the tumor is moved upward or laterally the uterus moves with it.

The use of the sound for diagnostic purposes is of questionable utility, as in some cases it may be arrested in its passage at two and



Dumb-Bell Fibroid of Uterus.

one-half or three inches, while, again, it may penetrate four or five inches in cases of elongated uteri from other causes than fibro-myoma. It may be impossible to make a differential diagnosis between some cases of tubular and ovarian disease, with adhesions to the uterus and fibro-myoma, without recourse to the exploratory incision. Again, in large, soft, pedunculated myoma, it may tax the surgeon's skill to differentiate the disease from a tense ovarian cyst. In either of these cases the exploring needle may serve to settle the diagnosis, if it must be made before operation; but it is safer and wiser not to use the needle unless the operator is ready to open the abdomen, either at once or within a few hours.



Fig. 805.

Sub-Mucous Fibroid, Dome of Uterus.—Weight, 3 ounces, Size of Goose Egg. Vaginal Extirpation Leaving Uterus Intact.—Runnels.

Fibro-cystic tumors of the uterus are difficult to diagnose from ovarian cysts. But usually a solid part of the fibroid can be mapped out, other hard growths found, and movements of the uterus stir the tumor, which is not often the case in ovarian cyst.

If the growth be interstitial or sub-mucous (Fig. 805) there may be excessive or protracted menstrual discharges. Not infrequently one hemorrhage scarcely passes off before another comes on, and thus the life of the patient is placed in great danger. If this metrorrhagia is habitually accompanied by uterine contractions the surgeon may strongly suspect sub-mucous fibro-myoma, and bimanual examination will probably show the os to be open, the uterus filled with the growth, and the sound may penetrate the organ from three to five inches. The

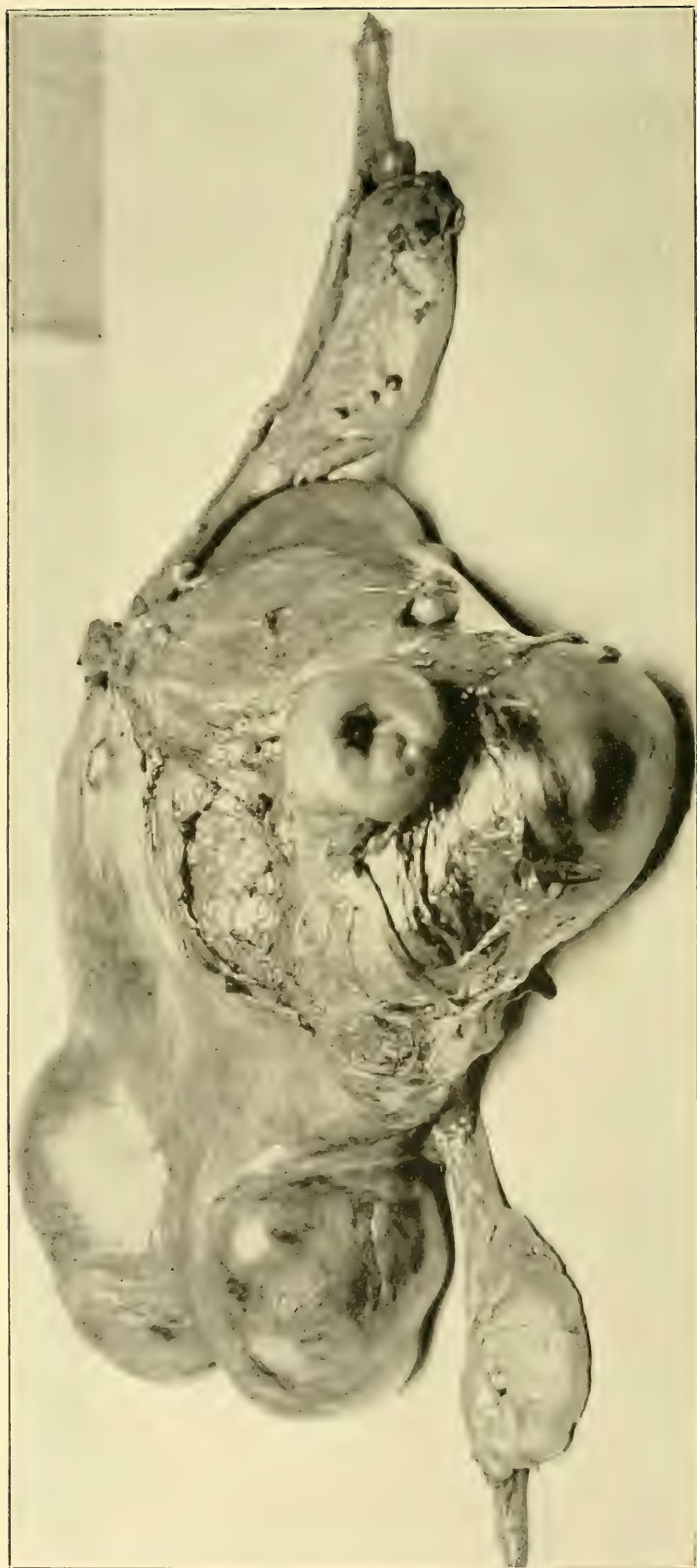
cervix should be dilated by the introduction of gauze-packing daily for two or three days, or by other methods; then the finger of one hand is to be introduced and the tumor palpated, when the diagnosis will be rendered certain.

Prognosis.—This disease, as a rule, does not tend to a fatal result. In many cases there are no symptoms whatever, and the patients go on to the menopause and even through life without any ill-consequences except, perhaps, that they are sterile. In others, instead of the tumor shrinking at the climacteric it develops to enormous proportions, and the patient dies from malnutrition due to compression and functional derangement of many organs.

In one patient there may be serious disturbance of the stomach, the liver and the bowels, while there is retention of urine, tenesmus or hydronephrosis. Again, there may be malignant degeneration of the growth, metrorrhagia, pelvic abscess, pyosalpinx, ovarian cyst, or obstruction of the bowels. Or other conditions even more dangerous to life, if possible, are encountered; as pregnancy in the case of large myo-fibroma of the lower segment of the uterus, which if not dealt with early may sacrifice both the mother and her offspring. There is sometimes hemorrhage during gestation, after delivery, or the post-partum breaking

down of a sub-mucous fibroid and speedy death from sepsis. The disease, of course, is not always so deadly, but the suffering and disability which result from the malady often make it necessary to resort to surgical treatment.

Fisher, Chicago, reports a case, *Medical Century*, March 15, 1894, in which a seven pound fibroid complicating pregnancy lay impacted in the pelvis so securely that it was with difficulty that it could be lifted from its bed. It consisted of four fibroid bosses, in the center of which was the uterine cavity containing a three months male fetus and placenta. (Plate XLII). Increasing pressure symptoms necessitated abdominal hysterectomy, recovery following.



Pregnancy Complicated by Uterine Myoma. Lee.

PLATE XXXIX.

CHAPTER II.

TREATMENT OF FIBRO-MYOMATA OF UTERUS.

General Consideration.—Fibroid polypi of the cervix should be removed by excision. If the hemorrhage is free it should be arrested by running overhand sheep-gut sutures, passed beneath the bleeding points in such a manner as to stop the flow of blood and approximation of the cut borders.

Polypi from the endometrium or body of the uterus should be removed by torsion or excision. But as the endometrium is generally inflamed and there is a condition known as fungoid endometritis it is usually necessary to curette and pack the cavity with iodoform-gauze, which should be removed at the end of the first or second day.

In the submucous or interstitial fibro-myomata ergot may be given hypodermically, not only to cause shrinkage of the tumor and arrest the hemorrhage but to induce the womb to contract and cause the tumor to descend or even become pedunculated. The formula in common use is:

R

Squibb's aqueous extract ergotine..... 1 part.

Aquæ 10 parts.

Add salicylic acid to each half-ounce of solution. gr. 1.

It should be used with a hypodermic syringe which should be kept perfectly aseptic and used for this purpose alone. The injections are begun with one grain daily, and gradually increase until quite perceptible uterine contraction is produced. If, for any reason, there is objection to the use of this drug hypodermically it may be administered by the mouth.

Preparatory Treatment.—When the patient has become exhausted from severe and protracted hemorrhage it is necessary to improve the strength, if possible, before myomectomy or any of the capital operations

are performed. The best course to pursue is to curette the uterus and free it from all adenoid growths, and pack it carefully with iodoform-gauze, which should be torn in strips two inches wide and prepared like roller bandages. This is removed in from twenty-four to forty-eight hours and the vagina kept aseptic by daily vaginal douches until the discharge ceases. This in ninety cases out of one hundred will arrest the hemorrhage when other methods fail and thus make it possible for the patient to gain flesh and strength sufficient to enable her



Fig. 806.

Enucleating Large Multiple Myo-Fibroma.—Macdonald.

to withstand the indicated capital operation which in most cases alone can cure her.

Enucleation.—(Fig. 806). The patient should be prepared as for

vaginal hysterectomy and placed in the dorsal position. After the cervix has been carefully dilated, if there is not sufficient room in which to work, its opening may be still further enlarged by incision. When the tumor is brought into view by a convenient volsella forceps the capsule may be divided from above downward and cut away so as to expose the growth. Now a strong hold is taken with the volsella forceps, and while making firm traction on them the neoplasm is peeled out of its bed by means of blunt-pointed scissors curved on the flat. If fibrous bands hold the tumor (Fig. 807) they may be divided by the scissors or Thomas' saw-spoon. When the tumor is dislodged, if found too large to pass through the cervix, it should be cut in pieces and removed. All loose shreds and redundant capsule should be trimmed away and the uterus washed out and packed with iodoform-gauze, which serves to control the hemorrhage. Many women have lost their lives from this operation through the intervention of septicemia. With our present aseptic methods this complication should not often develop. Be this as it may, if the woman is sterile, has a troublesome displacement, the appendages are hopelessly diseased, or the tumor is four or five inches in diameter, total extirpation of the uterus, either from above or below, is a safer operation and affords a more speedy and certain cure than enucleation.

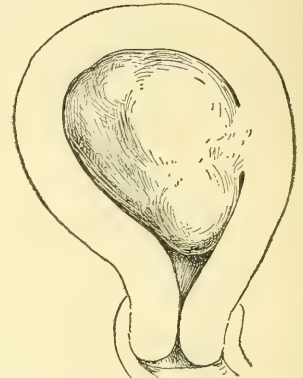


Fig. 807.
Tumor Held by Fibrous
Bands.

The after-treatment of enucleation should be conducted upon perfect aseptic principles. The wound should be frequently irrigated and drained by gauze-packing rather than by tubes.

The removal of large submucous fibro-myoma through the cervix piecemeal or by the method known as morcellation is a blind and consequently dangerous operation, and should not often be performed.

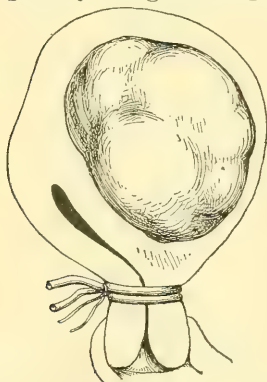


Fig. 808.
Fundus Uteri Secured with
Rubber Tubing.

If small or interstitial fibro-myoma incapacitate the patient through severe pain, suppuration or malignant changes, the safest and surest mode of treatment is by vaginal hysterectomy.

Myomectomy.—When the fibroid has a thin attachment to the fundus it may be transfixed with the double ligature, the two threads crossed, the pedicle tied in halves, cut and dropped back into the abdominal cavity, the same as in operations for ovarian cysts. Or, if the pedicle be an inch and a half thick a piece of rubber tubing may be carried snugly two or three times around the fundus and secured by the tying of a strong silk thread about the rubber tubing, so as to hold it with a firm grasp. (Fig. 808). This is the method introduced by Martin and serves to cut off the blood supply while the operation is completed. Towels are now packed around the uterus and a V-shaped incision made in the organ antero-posteriorly each side of the pedicle, care being taken not to enter its cavity. When the growth is removed the wound may be



Pregnancy Complicated by Fibro-Myoma. Hysterectomy. Recovery.--Lee.

closed either by deep interrupted sutures, or two or three rows of buried sheep-gut sutures, the last of which should neatly approximate the peritoneal coat. The rubber constrictor may now be removed, and if there is no hemorrhage from the wound the toilet may be made and the abdominal incision closed.

When the pedicle is very large the surgeon may choose between the last-named method and the fixing of the stump in the abdominal wound by the Kœberle *serre-nœud*, or the elastic ligature and Wilcox pins, exactly as is done in abdominal hysterectomy, with extra-peritoneal treatment of the pedicle. (Plate XLVI, Fig 2.)

In cases where the growth is not pedunculated the rubber band is employed the same as above, if possible, and the capsule of the tumor is incised to a sufficient extent to admit of the easy enucleation of the fibromyoma. (Fig. 806). When this is done trim off the borders of the capsule so they will come together without tension and sew up the whole bed of the tumor by several rows of buried continuous sheep-gut sutures, the last of which carefully coapt the peritoneum. (Fig. 809). This checks hemorrhage and yields the best results. When the tumor rises from the anterior or posterior portion of the cervix, and projects either behind the anterior or posterior vaginal wall, the overlying mucous membrane should be incised, and the tumors enucleated through the vagina in much the same way as is practiced in other forms of myomectomy. This operation is especially useful when growths in these sites complicate pregnancy and prevent delivery; or total extirpation of the uterus may be resorted to at the discretion of the surgeon.

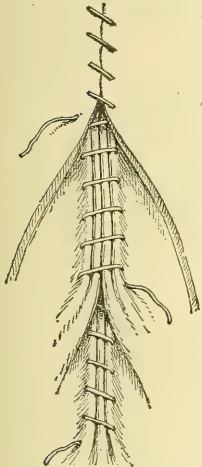


Fig. 809.

Tumor Bed Sewed Up.

Abdominal Hysterectomy.—There are four distinct methods by which these growths may be removed by hysterectomy through the abdomen: first, extra-peritoneal treatment of the pedicle; second, intra-peritoneal treatment of the pedicle; third, total extirpation of the uterus, ovaries and tubes, if desired; fourth, abdomino-

vaginal hysterectomy.

ABDOMINAL HYSTERECTOMY BY EXTRA-PERITONEAL METHOD. *Preparation of patient, surgeon and his assistants:* The vulva must be shaved, the vagina thoroughly and repeatedly douched for a day or two with antiseptic solution, the abdomen, external genitalia and thighs scrubbed, a bichloride dressing applied the night before the operation and a laxative given. When the patient is placed on the table and is anesthetized the vagina must again be douched with a bichloride solution, washed out with the fingers, and, if either complete abdominal hysterectomy or the abdomino-vaginal operation is to be performed, the cervix is packed with gauze. Then the abdomen, external genitalia and thighs are quickly re-scrubbed, rinsed with sterile water and bathed with bichloride. The parts are painted over with a ten per cent. solution of iodoform and ether, moistened bichloride towels are spread about the site of the proposed wound and the patient is ready for operation.

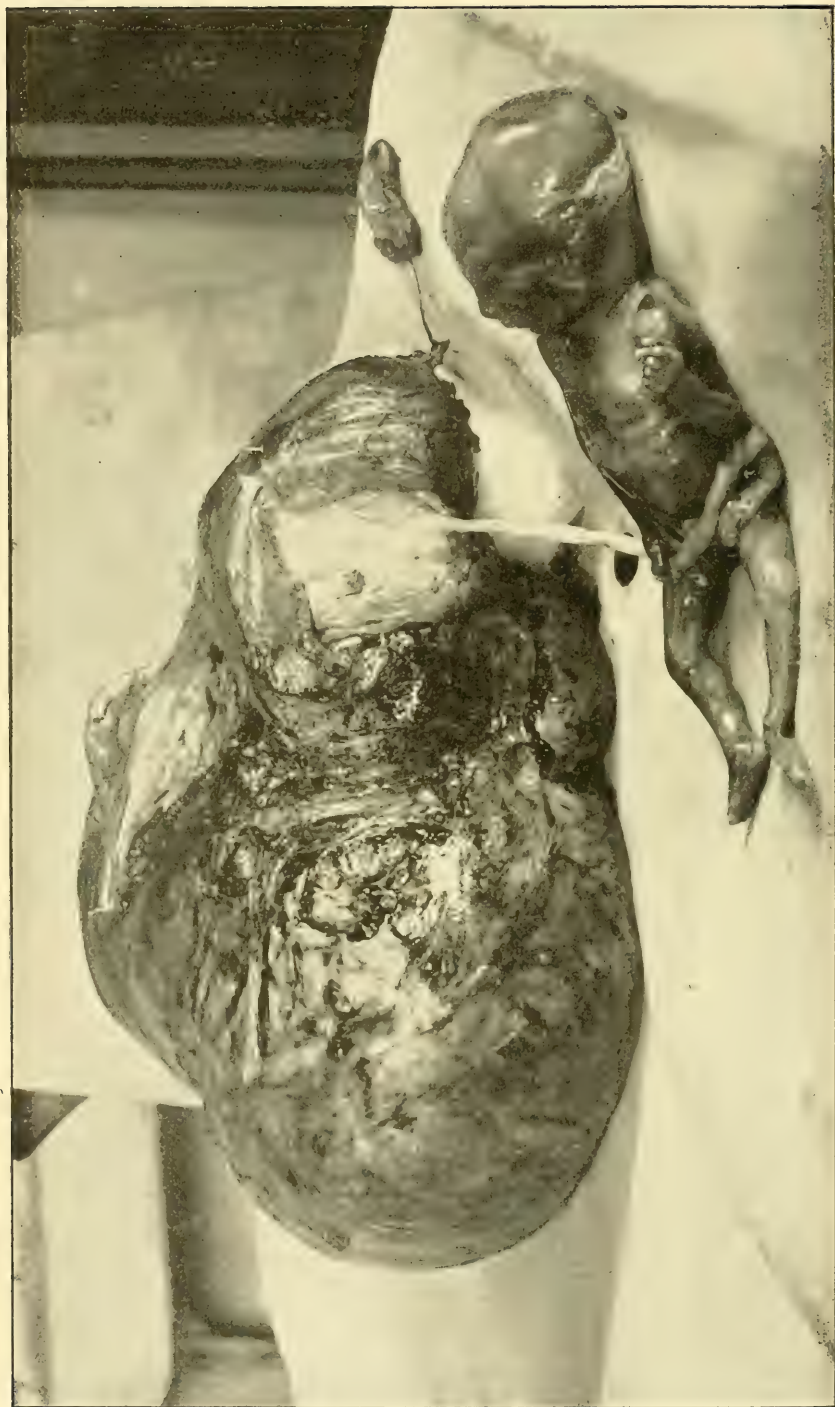
If any of the assistants have been in attendance upon pus cases within forty-eight hours they should be excluded; the hands of all the others

should be scrubbed in soap and hot water for ten minutes and the nails carefully cleansed; lastly, the hands and forearms are given a bichloride, then an alcohol bath. If an assistant has been in contact with questionable wounds and it is unavoidable that he take part in the operation his hands and forearms must be scrubbed as above, then bathed in a solution of permanganate of potassium until they are of a deep mahogany color, which should be removed by a solution of oxalic acid, then washed in bichloride, 1 to 1000 and lastly in alcohol. The surgeon and all of his assistants should provide themselves with suitable caps and gowns which completely cover the hair and clothing from the neck to the ankles.

When the instruments, all appliances and materials have been sterilized and thoroughly prepared the operation may proceed.

The size of the tumor is estimated and the surgeon at once makes an incision of sufficient length in the linea alba through which to deliver the tumor without contusion of the peritoneum at the borders of the incision. A myomectomy screw or large corkscrew is firmly introduced into the tumor, and the growths, together with the uterus, are gently turned out through the incision and the intestines held back by towels properly applied over them. If the broad ligaments prevent sufficient delivery of the tumor they may be divided between the two ligatures, so as to include the ovaries and tubes, or not, at the discretion of the surgeon. Then an elastic ligature is drawn twice taut around the neck of the uterus, crossed in front, and held by an assistant while the surgeon encircles it twice with a strong piece of braided silk and securely knots it around the rubber so as to hold the elastic ligature sufficiently tightly about the neck to completely check hemorrhage. (Plate XLVI, Fig. 1). If preferred, Kœberle's *serre-nœud* may be employed instead of the elastic ligature. If this instrument is used it becomes necessary to turn it up from time to time, as the stump shrinks, so as to prevent secondary hemorrhage.

The peritoneum or capsule of the tumor is now incised all the way around at a point two or three inches above the wire or elastic ligature, and traction is made on the corkscrew. This causes the tumor to slip upward out of its capsule to a considerable extent and gives a better pedicle. Wilcox' transfixion pins are next passed obliquely through the pedicle, immediately above the wire or elastic ligature, and the tumor is cut away three-quarters of an inch above the pins. The broad ligaments, the bladder and the intestines are now to be inspected. If a bleeding point is discovered in the broad ligament it is secured with a ligature. If the elastic ligature or wire of the *serre-nœud* is found to grasp the bladder, ureters or intestines, they are released. As a matter of fact, when the constrictor is applied the surgeon should be cautious to place it where he intends it to remain. If this is done the inspection only serves to reassure him that all is right. The peritoneum is stitched to the stump below the constrictor and then carefully closed by means of a continuous suture. The rest of the wound is closed by deep sutures of silk-worm gut which include the skin and aponeurosis but stop short of the peritoneum. The two next to the pedicle on each side should be passed through all the thickness of the abdomen and made to pierce the peritoneum of the stump below the constrictor so as to insure union between the parietal peritoneum and that of the stump just below the elastic ligature or wire or the



1. Fundus Uteri.
2. Right Ovary,
Removed by Extra-Peritoneal Treatment of the Pedicle, or Porro Operation. Lee.
3. Left Ovary.
4. Placenta Attached.

serre-nœud, whichever method may be selected. The aponeurosis is brought together by buried sheep-gut sutures between the deep silk-worm gut sutures. Then the silk-worm sutures are tied down and if necessary the skin is approximated between them. When the abdomen is closed a strip of gauze is carried around the stump just beneath the needles, Sims' abdominal protectors are put in place, the ends of the needles are carefully adjusted over them, and the wound is at once covered with gauze. Now, with a bit of cotton, perchloride of iron is dusted over the top of the stump so as to harden it and prevent sloughing at this point. More dressing is placed over the entire wound, including the stump, and a four-tailed bandage applied. If Kœberle's serre-nœud instead of the elastic ligature has been employed it is necessary to turn down the screw a little from time to time during the operation and for several days afterward to prevent hemorrhage as the stump shrinks.

This operation is only applicable to cases in which the cervix is sufficiently free from the tumor to admit of a good pedicle. (Plate XLVI, Fig. 3). The wound should not be dressed until the eighth or ninth day, when all the stitches should be removed. From this time on while the pedicle is undergoing the process of sloughing the wound should be dressed daily, iodoform dusted about the stump, and gauze packed loosely between it and the abdominal wall. The stump usually comes away in from eighteen to twenty days. If at the end of this time it seems to be firmly attached the constrictor had better be removed and the pedicle cut away. The conical cavity left after the pedicle sloughs should be packed loosely with iodoform-gauze and allowed to fill up from the bottom.

The objection to this operation is that it takes from six to eight weeks before the patient can be discharged from the hospital, and that sometimes a fistula is left in the site of the pedicle, or hernia develops, although a properly adjusted pad and bandage may be constantly worn for six months. This operation is not usually performed where adhesions are extensive, so drainage is not often required; but if it should become necessary a glass tube, as usual, should be inserted between the stitches two inches above the stump, and the fluid pumped out with a glass syringe to which a rubber tube is attached.

HYSTERECTOMY BY INTRA-PERITONEAL METHOD. The abdomen is opened to a sufficient extent to admit of easy eventration of the tumor, and the peritoneum divided at the upper angle of the wound so as to avoid the bladder if it is adherent to the abdominal wall. If the growth is bound down it must be drawn upward as much as is possible and the broad ligaments tied beyond the ovaries as near the pelvis as may be without involvement of the ureters or iliac arteries. Ligatures are passed close to the uterus on each side and are tied, or two pairs of Wells' forceps may be employed instead. When the ligament is cut across as low as the bottom of the included tissue the process is repeated, taking care, to pass if possible, a double ligature close to the cervix and beneath the uterine artery, which may be felt pulsating at the side of the pelvis near the internal os. The loop of this ligature is cut and one-half tied down close to the uterus, and the other far enough away on the pelvis side to secure a good pedicle. Or, in place of the ligature contiguous to the uterus, Wells' forceps may be again employed

on both sides. Now, with the exception of small vesical and hemorrhoidal arterial branches the blood supply to the uterus is entirely cut off, which may be removed by a V-shaped incision transversely across its anterior and posterior aspects so as to bring the bottom of the incision on a level with the internal os. The actual cautery is applied to the cervical canal to render it aseptic, and the wound is closed either with two or three rows of continuous buried sutures, or else a row each of deep and superficial interrupted sheep-gut sutures.

Whichever method is employed all hemorrhage must be arrested before the abdomen is closed, and in troublesome oozing from the stump two or three rows of buried continuous sheep-gut sutures are very efficient. If adhesions are encountered abdominal drainage had better be employed for a day or two.

TOTAL ABDOMINAL HYSTERECTOMY. The patient must be thoroughly prepared, the same as for both vaginal and abdominal hysterectomy, and the strictest aseptic and antiseptic principles observed.

The next item of importance, as in most other pelvic operations, is the Trendelenberg position. Without this it would be well-nigh impossible to successfully complete the operation. The instruments required are Deschamps' needles, or a good aneurism needle, together with such an outfit as is usually necessary in abdominal section for ovariectomy. The abdominal incision should be made sufficiently long at first to readily deliver the tumor. After it has been gently drawn out the intestines are pressed back out of the pelvic cavity and retained by towels or large, flat gauze pads packed in the abdomen. The protectives also absorb the discharges and may prevent diffuse infection if septic elements exist. The blood supply to the uterus, with the exception of the vesical and hemorrhoidal branches, is through the medium of the ovarian and uterine arteries. A strong, braided-silk ligature, double, is now passed through the broad ligament beneath the ovary, so as to include an inch and a half of the upper surface of the broad ligament. The ligature at its loop is cut so as to leave two threads of equal length about fourteen inches long parallel to one another. Care must be taken not to cross them. The outer ligature is grasped with the two hands and traction is made outward away from the uterus, so as to separate it from its fellow by tearing slightly the tissues of the broad ligament. It is then tightly knotted and the ends are cut short. The same process is repeated on the ligature next to the uterus, which is tied down close to the horn of that organ. Exactly the same process is repeated on the opposite side of the womb, then both ovaries are cut away, as well as the tubes between the two ligatures, to a point as low as the perforation made by the aneurism needle. When this is done no more silk is to be used as ligatures, but a medium sized sheep-gut of good quality is to be substituted, and the tying off of the broad ligaments and uterine arteries is completed by what is known as the progressive ligature, as done from below in vaginal hysterectomy, except that occasionally it is necessary to apply forceps to the stump on the uterine side. Deschamps' needle, or an ordinary aneurism needle, is passed through the broad ligament within one-half inch of the uterus at first, so as to include a portion of the broad ligament about one-half inch deep. This is tied down, forceps are applied to the uterine side if necessary, then the broad ligament between is



Figure 1.
Superior Aspect Indicating Position.

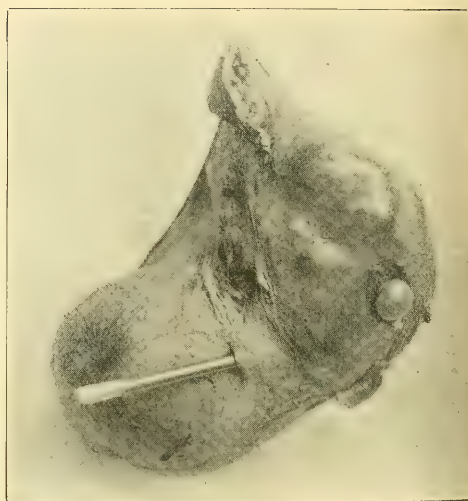


Figure 2.
Inferior Aspect.—Staff in Os Uteri.



Figure 3.
Tumor and Uterus Incised, Fetus Exposed.



Figure 4.
Tumor Incised; Fetus in Uterine Bed.

severed as far as the perforation of the Deschamps needle. The ureters are now recognized if possible and exactly the same step is repeated two or three times, passing the needle close to the uterus as its lower anterior lateral aspect is reached. The organ is then turned to the opposite side of the pelvis and steady firm traction is made upon it by means of the corkscrew, held by an assistant, the same technique being repeated on this side of the uterus.

A No. 34 conical urethral sound is now introduced into the vagina and made to pass upward behind the cervix, where it is steadily held by an assistant while the surgeon makes an incision through the tissues close to the uterus and opens into the vagina on the instrument. The sound is now placed in front of the cervix, the peritoneum above the bladder divided, the organ carefully dissected off, mostly by the fingers, and the vagina opened either on the sound as a guide, or it may be removed and the finger passed through the posterior incision and used instead.

Both uterine arteries may now be located by their pulsation, and secured. The lateral utero-vaginal connection may be divided close to the uterus without hemorrhage and the mass lifted out of the pelvis. All clots and debris must be removed and a search made for bleeding points. If they are so situated as to admit of the application of artery forceps and sheep-gut ligatures they should be tied. If, from softened tissue, general oozing, or other causes, this method of hemostasis is not practicable, a No. 1 or No. 2 sheep-gut ligature, eighteen or twenty inches long, is passed through the tissues at a point below the bleeding surfaces, care being taken not to include the ureters or other important structures. When this is done the bleeding surface is sewn up by an overhand running suture, the stitches of which are passed a quarter of an inch apart. When the bleeding has been arrested the wound is dried and closed.

A piece of No. 2 sheep-gut eighteen inches long is passed through the peritoneal flaps on the right side just below the stump of the ovarian artery, which should not be covered. The borders of the peritoneum are drawn with an overhand suture over the short sheep-gut stumps, which project very slightly, until the bladder and rectal flaps are reached, when a moment's halt is made, and with a pair of long bird-stuffing forceps a two-inch strip of iodoform-gauze is carried from the pelvis through the wound into the vagina, while an assistant is directed to place his fingers into the cavity, draw down the gauze one foot and curl it up in the vagina. The surgeon cuts the end off three inches above the vaginal wound on the pelvic side and curls it down just beneath the recto-vaginal flaps. This affords excellent drainage, especially in enucleations from the pelvic floor.

The surgeon again takes up the needle and approximates the recto-vaginal flaps by a continuation of the overhand suture, which stops on the left side just below the stump which includes the ovarian artery. The pelvic cavity is carefully dried out, the towels or pads are removed, and the patient is restored to the horizontal position. The omentum is brought down under the site of the abdominal incision, and the wound is closed in the usual way. The parietal dressings are retained by a many-tailed flannel binder, to which a perineal strip is attached as a T-bandage, to hold the dressings over the vulva.

This is an ideal operation. It is applicable to all the cases to which the preceding forms of hysterectomy are applied, as well as to those suited to the abdomino-vaginal operation, and so far as is known is original with the author.

As the operation is more commonly performed with the use of silk ligatures throughout, that method will also be described: The broad ligaments are tied *en masse* in two or three sections, so as to form distinct pedicles on each side, as described in the articles on hysterectomy by the intra-abdominal method on page 1283. The uterine artery should be located by its pulsation and the lower ligature made to encircle it, taking care to keep close to the uterus, so as to avoid the ureters on each side. They are not more than three-quarters of an inch from the cervix, normally, and may lie close to the tumor. If the whole broad ligament has been secured so as to form two pedicles on each side the upper one includes the ovarian artery and the lower one the uterine artery. The threads on the upper ones are cut short, while those which include the uterine arteries are left long. After the bladder and rectum have been dissected off as in abdominal hysterectomy these lower threads are brought down in the vagina with the pedicles and left. Now, a long piece of No. 2 sheep-gut is started in an overhand running suture in the broad ligament on the left side just below the stump of the ovarian artery and continued down to the recto-vesical flaps, which it approximates over the lower stumps, and threads left long in the vagina. Gauze drainage may be introduced as in the last operation and removed on the second or third day. The ligatures about the lower stumps come away by gentle traction from the tenth to the fifteenth day, when the pedicles slough. Sometimes it is impossible to remove them even at the end of six weeks after the patient is up and about the house. This is a serious objection to the operation, which the progressive sheep-gut ligature from above effectually corrects, and, so far as ascertained, no evil effects from sepsis or hemorrhage have followed.

Abdomino-Vaginal Hysterectomy.—This operation is begun with the patient in the lithotomy position, and the steps of the operation are the same as for abdominal and vaginal hysterectomy combined. After a thorough antiseptic douching and washing out of the vagina with the fingers a sound is introduced into the bladder, and the lower border of its attachment to the cervix determined by the beak of the instrument. The uterus is now drawn down with the volsella forceps and a circular cut made through the mucous membrane completely around the cervix. The bladder and rectal attachments are now pushed up with the thumb to a greater or less extent, and the uterine arteries tied with sheep-gut. If there is much hemorrhage the jetting vessels may be secured by the ligature or a piece of gauze packed in the wound. The patient is then quickly placed in the Trendelenberg position, the abdomen opened, and the operation completed by means of the progressive ligature from above, precisely as laid down in the operation for total extirpation of the uterus and appendages through the abdomen. In cases of enucleation of tumors from the pelvic floor one gains quite an advantage if the landmarks are defined by incisions in the cervix from the vagina even if the uterine arteries are not reached and tied. It also assists the operator if a part of the long dissection can be made from below.



Figure 1. Uterine Myoma. Hysterectomy. Lee.



Figure 2. Uterine Myoma—Hysterectomy. Salpingo-Oophorectomy a year previous without check in growth of Tumor, which doubled in size. Telangiectasis was a complication. Lee.

Salpingo - Oöphorectomy:—FOR THE ARREST OF HEMORRHAGE AND THE GROWTH OF FIBRO-MYOMA. This operation has been performed for many years for the relief of these tumors. But since it is not applicable in growths which spring from the lower segment of the uterus, and dissect their way between the folds of the broad ligaments, or project backward or forward into the rectum or bladder, and since hysterectomy has to be done in some cases in which the ovaries were removed when these conditions were not present, it seems that the operation had better be abandoned in favor of extirpation of the uterus. The mortality in salpingo-oöphorectomy for fibro-myoma is but a trifle lower than in hysterectomy, the difference being so trifling as not to militate against the latter operation. Of course, in cases where the tumors have to be enucleated from the pelvic floor the mortality is much higher, placed by some authors at fifty-three per cent., though this is too high by one-half at the present time. When it is remembered that these operations are left as the last resort, when the functions of the bladder, kidneys, or other organs are dangerously impaired, when the pressure-symptoms have exhausted the patient, or even placed life in jeopardy from such dangerous conditions as obstruction of the bowels, a mortality of from twenty-five per cent. to fifty per cent. does not seem high. So, then, these operations are resorted to when the patient's condition is regarded as hopeless, and even if only a half or three-quarters of the cases are saved this treatment is of inestimable benefit. The mortality of hysterectomy for fibroids in suitable cases should not be over four per cent. or five per cent. and enucleations from the pelvic floor in cases where life is well nigh destroyed before the surgeon is called should not be included.

One of the anomalies of surgical practice is the occasional disappearance of pathological lesions after exploratory laparotomy. Uterine myomata sometimes disappear after abdominal incision from inexplicable reasons, as is also the case in abdominal tuberculosis.

For Hysterectomy per vaginal route consult Section on Surgery of the Lower Orifices.

CHAPTER III. COMPLICATIONS.

Intra-Ligamentous Fibro-Myoma.—As seen from Fig. 810, these tumors grow upward between the folds of the broad ligament and are entirely covered by this tissue. On account of the numerous sources from which they derive blood supply, it is worse than useless to attempt to arrest their growth by the operation of salpingo-oöphorectomy. Indeed where the tumor is more than four inches in diameter no operation except that of total abdominal hysterectomy, or possibly in occasional cases the intra-abdominal treatment of the pedicle, will suffice.

In their removal the surgeon's ingenuity will be taxed to its utmost to know how best to complete the operation. It is quite impossible to lay down any fixed rules to govern such cases, for the conditions in no two patients are alike. When the tumor projects between the folds of the broad ligament on one side only, as in the case of Fig. 810, the



Fig. 810.
Intra-Ligamentous Fibro-Myoma.

operator had better at once proceed to divide the ligament on the unaffected side. After this has been done as directed in the operation for total extirpation of the uterus, and the ovarian and uterine arteries secured on one side, a thirty-four conical urethral sound is passed into the vagina in front of the cervix and a circular cut is made through the peritoneum only, a half-inch above the bladder, and this organ is quickly dissected off by means of the fingers, aided by the division of a few fibrous bands with the scissors. When the sound is felt in front of the cervix an opening is made into the vagina by its beak as a guide. The rectum is dissected away from the cervix in the same manner and it will now be found that the tumor will come up out of the pelvis to a marked degree. The uterine artery on the opposite or affected side is tied with sheep-gut, the posterior portion of the capsule divided and the tumor enucleated from its bed by the fingers, assisted by a pair of blunt scissors curved on

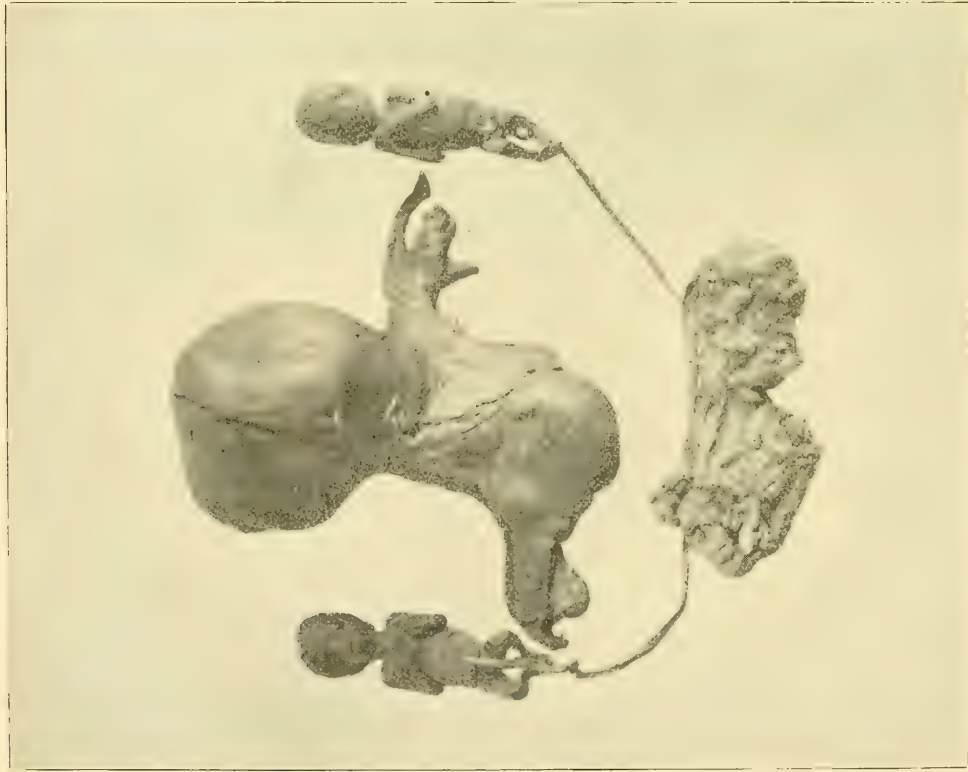


Figure 1.



Figure 2.

Uterine Fibro-Myoma Complicated by Twin Pregnancy.—Chislett.

the flat. When the uterine artery on the tumor side is reached the ureter is recognized, if possible, that it may be avoided by the ligature, and the artery is tied with sheep-gut. If the ureter cannot be located care is taken to keep close to the tumor, rather into its substance than out of it else the important structure may be injured. The tissues are now severed, and the balance of the broad ligament is carefully tied off either from above or below by means of the progressive ligature. When the tumor is removed, the ureter in its entire course through the pelvis may be laid bare or even detached from its bed. The author has had three such cases, all of which made good recoveries.

If the tumor involves both broad ligaments the tubes and ovaries are tied off on both sides; the capsule of the tumor is then incised and enucleated so as to reach the uterine arteries. Next the rectum and bladder are dissected, and the vagina is entered anteriorly and posteriorly. In case the cervix is drawn well up, as is usual, out of the reach of the finger a large conical urethral sound passed into the vagina makes a good guide for the surgeon to dissect upon while these organs are freed from the cervix. The ureters are to be avoided, but as they can not always be located the sheep-gut sutures are passed around the uterine arteries close to the uterus and tied securely. Then the cervix can usually be dissected from its only lateral attachment without much hemorrhage. The anterior and posterior flaps are next brought together, and if they are too full are cut away until the bladder and rectal peritoneum come together neatly. Clots and debris are cleared away and if there are bleeding points they are tied by means of the sheep-gut ligature. If there are troublesome oozing surfaces they are sewed up with a running sheep-gut suture until all hemorrhage is arrested. In this last step of the operation the surgeon must take great pains not to wound the ureters, iliac arteries or other organs. When there is no hemorrhage and the toilet is made the wound is sewed with gauze drainage in the vagina, to which attention has been directed in the operation for total extirpation of the uterus and if there is oozing into the abdominal cavity, or liable to be, a glass drainage tube is passed through the abdominal wound down to the deepest cavity of the pelvis, as is commonly done in cases of adhesions in ovarian operations.



Fig. 811.
Uterine Myoma, Piecemeal Enucleation.

In another instance, where the mass is united to the uterus by thin attachments, this organ itself might be removed first with a portion of the tumor and the balance enucleated afterwards piecemeal, as shown in Fig. 811.

Fibro-Myoma Springing From the Lower Segment of Uterus.—When the growth springs from the lower segment of the uterus

beneath the peritoneum of the pelvic floor and from thence projects against the bladder or rectum, the operation is by no means as serious as in foregoing cases.

The rule is to divide the peritoneal coat or capsule of the tumor and enucleate the projecting nodules by the fingers, assisted by the scissors if necessary. If this is not done the surgeon will be more than likely to wound the bladder or bowel. If adhesions are encountered it is better not to divide them unless they are favorable for the application of the liga-



Fig. 812.
Large Uterine Myoma.—Macdonald.

ture or stripped off readily with the fingers; it is better to divide the capsule with the knife and enucleate the growth to a point beyond the intestinal adhesions, and exsect a portion of the capsule so as to leave it attached.

Telangiectasis of Fibro-Myoma.—In this complication the large and small vessels are so enormously dilated that the patient may succumb from even the volsella punctures of the cervix, or slight wounds of any part of the tumor if the operation is not speedily completed. When such a condition presents in growths which involve the pelvic floor or the fold of the

broad ligaments (Plate XLV, Fig. 2), the usual sites, a most dangerous complication confronts the operator; if he does not give the patient the benefit of the surgeon's art she will in all probability die, and if he does her chances are not more than even. These are the conditions which call for a cool, deliberate decision, and test the courage of the surgeon. If when the abdomen is opened he concludes to remove the tumor, normal salt solution—chloride of sodium, grs. xxx, carbonate of soda, grs. v; sterile water, $\frac{3}{4}$ x—should be in readiness for introduction into the cellular tissue two inches below the axilla. Ten ounces may be used on each side by means of an aseptic fountain syringe with a delivery tube three feet long to which a fine aspirator needle is attached. The rubber bag should be kept partially immersed in a pail of water at a temperature of about 120 degrees Fahr., so that when the solution reaches the patient it will be about 100 degrees. The fluid is rapidly absorbed and the effect is quite as good as that from transfusion.

Complications After Operations.—Those which usually carry off patients are shock, hemorrhage, heart-clot, and septic peritonitis, in the order named. Preventive treatment is the best course in all of these diseases.

SHOCK. Shock should be avoided by a room heated to a temperature of seventy-five to eighty degrees Fahr., protection of the body by proper



Fig. 1.
Stump Prepared for V Incision.



Fig. 2.
Stump Partially Closed by
Two Rows of Continuous Sutures



Fig. 3.
Gauze Drain in Place.



Fig. 4.
Wound Sutured over the Drain.

clothing and heaters, and quick operations. The last proposition is the most important, therefore no one ought to enter upon the practice of abdominal hysterectomy until he has had considerable experience with the simpler forms of peritoneal surgery; this alone will enable him to develop the dexterity requisite to complete the uncomplicated operations in from one-half hour to an hour, and the complicated ones in an hour and a half to two hours, which is so necessary to insure a fair degree of success.

HEMORRHAGE. This may be avoided by a thorough knowledge of anatomy, the use of good sheep-gut, the skill to safely tie it, and the securing of large vessels before they are cut.

HEART-CLOT. As heart-clot most frequently follows profuse loss of blood the prevention of hemorrhage lessens to a marked degree the danger of death from this cause.

SEPTIC PERITONITIS. This is the result of infection, and when it occurs some person or appliance in contact with the operative wound was unclean in the surgical sense, or else the patient was not properly prepared. One of the saddest events in the surgeon's life is experienced when an individual entrusted to his care is lost from sepsis because of failure to secure a faultless preparation. When these unfortunate cases overtake the operator nothing should deter him from the most painstaking effort to ascertain the cause. A trusty person ought to keep a general oversight of the movements of the assistants, lest, unwittingly, they contaminate themselves or the outfit while the surgeon is absorbed in his work. Perhaps it will be impossible to discover the sources of the sepsis, yet there should be a more rigid enforcement of aseptic principles.

CHAPTER IV.

OPERATIVE TREATMENT FOR UTERINE DISPLACEMENT.

Alexander's Operation.—Alexander's operation, or shortening the round ligaments, is applicable in a limited number of cases which are free from other pelvic lesions or adhesions. If endometritis coexists it should be treated by curetting and packing—procedures in themselves calculated to relieve certain cases of displacement. If the perineum is torn it should be repaired, and if a rectocele or cystocele exists it should be obliterated. The uterus should be replaced and maintained by a tampon, and an incision about two inches in length should be made from the pubic spine, directly over the inguinal canal. This incision opens the external ring and the round ligament found therein, lying beneath the fat. After this latter is incised the ligament may be raised by a blunt hook. It may be necessary sometimes to open the internal ring. When found the ligament is secured with a pair of forceps, the wound covered and the ligament upon the other side sought for in the same way. They are drawn out gently and stitched, the sutures passing through the pillars of the ring and through the ligament. Sheep-gut or silk-worm may be used. From two to four sutures may be necessary. When it has been necessary to open the inguinal canal it should be carefully closed, buried sutures of silk-worm or sheep-gut being used. The wounds are closed, after the slack portion of the ligament is cut off, and the uterus supported by tampons for several weeks.

Hysterorrhaphy.—(Ventro-fixation). This is indicated in intractable retro-displacement, with or without adhesions. It is often performed when the displacement is associated with some other pelvic or abdominal lesion, which demands the opening of the abdomen. An incision is made in the median line, the hand or two fingers introduced and the uterine fundus brought forward into the lower angle of the wound, where it is held by an assistant or a vaginal tampon, or both. Of course, the surgeon will have determined the condition of the ovaries and tubes and proceeded with their ablation before the abdomino-uterine sutures are introduced. Having determined the point at which the fundus can be attached, without impinging too much upon the bladder or making too much traction upon the utero-vaginal attachments, a curved needle (without a cutting edge) is passed through the abdominal wall and into the muscular structures of the fundus. It enters upon one side to the depth of one-eighth of an inch or a little more, and emerges upon the opposite side—about one-half or three-quarters of an inch from its point of entrance—is again grasped in the needle-holder and passed through the abdominal wall from within, outward. One or two others are introduced in a similar way, about one-quarter of an inch apart. These should be silk-worm sutures. Silk can be used, but it possesses no advantages. Sheep-gut is also used and left buried in the abdominal wound. Some have buried the silk-worm suture in the same way. Ordinarily it is in-



Fig. 1.
Pedicle Ligated.

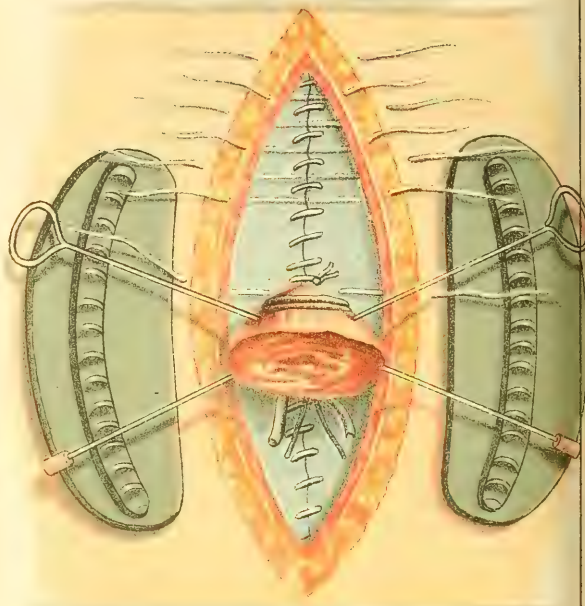


Fig. 2.
Sims Abdominal Protectors and
Skewers in Place.

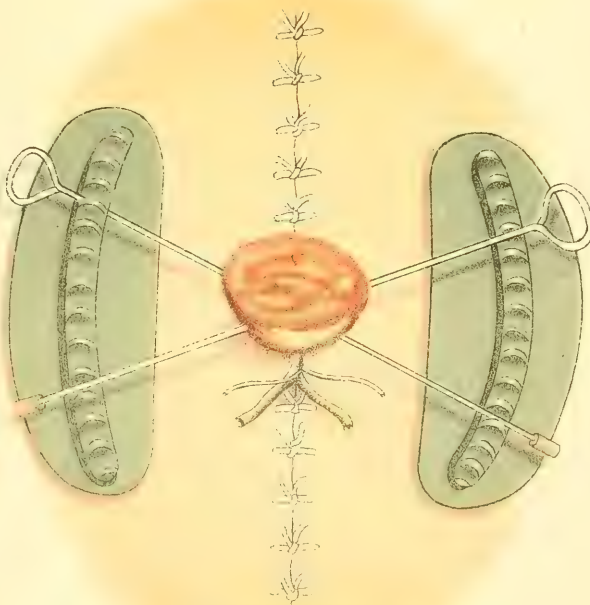


Fig. 3.
Wound Closed by Three Rows of Sutures.



Fig. 4.
Cholelithiasis - Macdonald.

roduced as above described, then the portion of the fundus which is to lie in contact with the abdominal wall is irritated and scarified with the scalpel handle and the abdominal wound closed as usual, the uterine sutures being tied first. (Fig. 813.)

The uterine sutures should be tied carefully—avoiding too much tension for fear of causing the sutures to cut through the uterine tissue. They should be tied differently from the others or left longer, so that they can be differentiated from the other sutures, which are usually removed a week or ten days earlier than those holding the uterus in place. The vagina should be tamponed for several weeks after the operation. The results are usually good.



Fig. 813.

**Fundus of Uterus Brought up into Wound;
Utero-Abdominal Stitches Introduced and
Held in Pedicle Forceps.**

CHAPTER V.

SURGERY OF THE OVARIES.

Congenital Malformations.—One or both ovaries may be absent, congenitally, although this is somewhat rare, and is generally found associated with uterine arrest or non-development. Accompanying this may be found a rudimentary kidney, and at times there is an associated congenital absence of the kidney. If but one ovary is present the opposite side of the uterus and tube is quite likely to give evidence of defective development. A third or supernumerary ovary is quite rare, and it is believed that in some such reported instances a small intra-ligamentous growth was mistaken for an ovary.

Displacement.—As stated in the Section on Hernia, the ovary is occasionally found protruding, with other structures, into a hernial sac. An ovarian hernia occurring without other structures is quite rare. It has been found protruding through the umbilicus, the crural canal, the sacro-sciatic foramen, and, in one case, to the author's knowledge, through the rectum. If unaccompanied by intestine, or with little or no omentum, it may be mistaken for an enlarged gland or a labial swelling. Its ovoid shape, the sickening sensation or nausea from pressure, and its swelling and aggravation at the menstrual period are the diagnostic signs.

TREATMENT. If the ovary can be reduced by careful taxis, associated with or subsequent to the employment of gravitation and cold applications, a properly fitting truss should be worn. If reduction is impossible by means of taxis, or if a truss fails to retain the ovary within the abdomen and it causes much annoyance, it should be treated as any other hernia. The sac should be opened and the ovary reduced if possible; if not, it may be extirpated, the sac cut away or ligated and the hernial opening obliterated.

Prolapsus.—The ovary is not infrequently displaced either in front of or behind the uterus, in Douglas' cul-de-sac. In the latter case there is often, though not always, an associated uterine displacement. It is associated also with subinvolution, ovarian hypertrophy and obstipation. The uterus frequently descends, dragging the ovary with it, and it is not at all uncommon for the examining finger in the vagina to find the ovary lying pressed beneath the uterus, against the rectum. Such an ovary is usually quite sensitive to the touch, which produces a sickening sensation, is often fixed and immovable, there is pain attending defecation and coitus, and dysuria and dysmenorrhea often coexist. Together with these symptoms there is frequently much pelvic distress or even disability.

TREATMENT. If the ovary is not enlarged, is non-adherent and can be pushed upward it may be possible to maintain it in a better position by means of a pessary, although this is by no means perfectly satisfactory. Lying upon the side, the relief of constipation, the assumption of the genu-pectoral position with admission of air into the vagina, and freedom from coitus form a portion of the routine treatment. When such meas-

ures fail to afford relief from the distress or disability and the ovary is diseased it should be removed by the abdominal route unless its condition is ascertained by the vaginal route when operating for some other lesion. In this instance the removal through the vagina is proper. If the ovary is not diseased and there is no other reason for its ablation its pedicle may be stitched to the abdominal parietes. If the ovarian prolapsus is secondary to or associated with uterine prolapsus or retroversion, shortening the round ligaments, or hysterorrhaphy, is justifiable.

Inflammation of the Ovaries.—ACUTE OVARITIS (oöphoritis) is caused most frequently by sepsis accompanying or subsequent to abortion, parturition, gonorrhea, endometritis and salpingitis. Inflammation of the ovary occurs primarily, but only infrequently as compared to secondary ovaritis from the above causes.

In well marked acute cases the ovary increases rapidly in size. In cases of some severity there is not only marked glandular inflammation, but section discloses, in some cases, pus streaks and in others small or large pus cavities. The ovary may vary from twice its normal size to that of a cocoanut. There is usually an associated peri-ovaritis or peritonitis with inflammatory exudate which walls in the ovary and protects the general peritoneal cavity. Fortunately the plastic exudate thrown about the ovary results in a thickened capsule, but there is a possibility of rupture in any direction. The fluid portion of the pus is sometimes absorbed, leaving an inspissated or cheesy mass which may be followed by calcareous changes. If the attack be mild and not attended with suppuration the inflammatory exudate is absorbed, the connective tissue contracts and the ovary may become sclerosed, perhaps subnormal in size, although such hardened ovaries are sometimes found larger than normal. The thickened capsule furnishes an obstacle to the rupture of a ripe Graafian follicle and the result is a cystic formation.

Symptoms. The symptoms are sometimes indefinite, because of the associated involvement of the tube and peritoneum. There are usually exquisite pain and tenderness, most frequently on the left side. The pain or distress is usually aggravated by touch, motion, defecation and menstruation. There may be frequent chills or chilly creeps and an elevated temperature.

Prognosis. The prognosis is good in the milder forms, but in neglected cases of suppurative ovaritis the prognosis should be guarded as to perfect recovery. The abscess frequently breaks into the rectum, affording temporary relief, but the attacks are quite likely to recur from time to time, making the patient miserable and endangering life from sepsis.

CHRONIC OVARITIS. This occurs with greater frequency than the acute form, although it may be engrafted upon the latter, and consequently may have the same etiological relations. There appears to be, in many instances, a neurotic element accompanying it. At least it has been observed that such lesions of the ovary seem to be encouraged by highly sensitized natures, by masturbation, menstrual disorders, sexual excess, or unsatisfied sexual desire. The ovary may be found either atrophied or somewhat enlarged and cystic, with certain portions sclerosed. It may be adherent from peri-inflammation and is frequently found prolapsed.

Symptoms. The symptoms are similar to those of the preceding variety, but are somewhat less intense and partake strongly of the hysterical. Mammary and infra-mammary pain, aggravated ovarian pain as the pelvic congestion of menstruation occurs, the painful defecation and painful coitus, and particularly the palpation (either with or without an anesthetic) of enlarged or sensitive ovaries are the classical characteristics.

TREATMENT. For the Acute Form. Rest in bed, hot fomentations and free movements from the bowels are essentials. The remedies most frequently indicated are bryonia, belladonna, aconite, arsenicum, rhus tox., pulsatilla, silicia and chininum arsenicum.

In the severer cases, which are unyielding and especially when an abscess has formed, the recognized treatment is abdominal section, ablation of the offending organs, or the usual treatment of an intra-abdominal pus sac.

Chronic Form. This demands the correction not only of the sexual habits but the general irregularities of life as well. Good, nourishing food, out-door air, moderate exercise, and in some cases massage and electricity are essential measures. Ignatia, lilium tigrinum, sepia, pulsatilla, cimicifuga, xanthoxylin, nux vomica, etc., will be found useful. When all such measures fail to afford comfort and chronic invalidism seems imminent the ovaries should be removed.



Large Ugrine Myoma.—Lee.
1854

CHAPTER VI.

ABLATION OF THE OVARIES---OVARIECTOMY, OÖPHORECTOMY, OVARIOTOMY, CASTRATION.

Applicability.—The removal of the ovaries is performed for various lesions, but the most frequent and important should be pathological conditions of the ovaries themselves. At the present time castration is not performed as frequently as in the past, for remote or neurotic lesions. It is the calmer judgment of a majority of surgeons that this has been done with

unjustifiable frequency. Besides inflammation, sup-puration and tumors of the ovary, castration is sometimes indicated for uterine fibro-miomata, intractable dysmenorrhea, associated tubal disease or tubal pregnancy, etc. The author, contrary to some authors, considers inveterate ovarian prolapsus another indication for ovariectomy, for the reason that it is sometimes responsible for the patient's complete disability, and because, in the author's experience, at least, the prolapsed ovary is a diseased ovary.

The preparation of the patient, the operative field, the surgeon, assistants, instruments, wipers, ligatures, dressings, etc., will be the same as advised in the chapter on antiseptis. As to time, when there are no urgent symptoms it is well to operate about a week or ten days after menstruation.

The operation seems to be quite well borne, even by old subjects. In 1892 a series of thirty-eight cases was tabulated, with but two deaths. The ages ranged from sixty-seven to eighty-two years.

Operation.—A simple castration requires but few instruments—the fewer the better. A scalpel, two pairs of heavy, rat-toothed dissecting forceps,

a pair of long straight or angular scissors for increasing the length of the incision, a pair of curved scissors, a few pairs of artery forceps or T forceps, a needle holder, three or four medium-sized, full curved needles, and a stout pedicle needle or aneurism needle are usually quite sufficient. With all abdominal operations it is wise to have a Paquelin cautery within reach. Although almost any kind of a needle may be used for closing the abdominal incision the author prefers a modification of Crawford's long-handled needle with increased curve, a slender neck and Hagedorn point. (Fig. 815). Different surgeons use different instruments, but the procedures are essentially the same. The patient should be laid with her hips and lumbar portions of the back in a laparotomy pad.



Fig. 814.
Abdom-
inal Re-
tractor.



Fig. 815.
Needle for
Closing
Abdominal
Wound.

The abdominal route is the only one requiring consideration. When the ovaries are removed by the vaginal route it is usually because this route has been selected for the treatment of some other lesion, or the removal of some other structures.

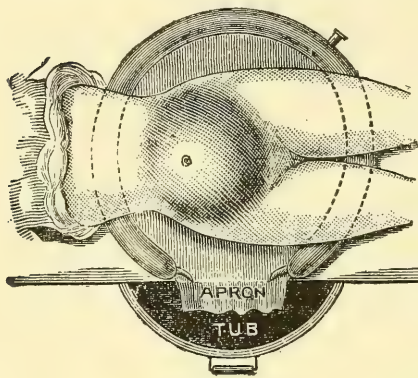


Fig. 816.
Operating Pad and Tub.

the incision does split the rectus muscle; for then good, broad coapting surfaces are formed, the union is stronger and consequently there is less likelihood of subsequent hernia. There is, of course, a little more bleeding in case the muscles are divided, but this need give no uneasiness. Hemostatic forceps, but no ligatures, are applied. The forceps are allowed to remain for a time, or may be removed toward the completion of the operation, when the bleeding will have been checked and the time required for the application of ligatures saved. The incision

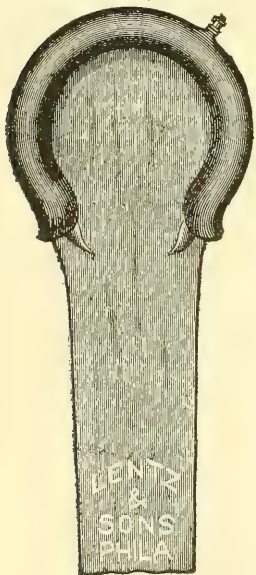


Fig. 818.
Kelly Pad.

INCISION. The incision is made about midway between the pubis and umbilicus in the linea alba; formerly much stress was laid upon the advisability of carrying the incision directly through this line, and directions were given in order to enable the operator to avoid divergence from the line and how to find it when the incision had been carried to one side. This is unimportant, in fact it is probably better if

need not be more than three inches in length to begin with, as it is a very easy matter to increase its length when necessary. The rule should be to have plenty of room to work in without unnecessary bruising, straining or pinching of tissues. So far as the incision itself is concerned there is no more danger in a long than a short one. The only objection to the long incision is in the increased time necessary to its coaptation and the somewhat enhanced possibility of subsequent ventral hernia.

The skin, just below the umbilicus, is steadied with the thumb and finger, and the scalpel is swept downward toward the pubis. No time should be lost looking

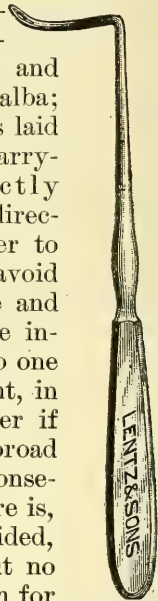


Fig. 817.
Greene's
Long
Needle.

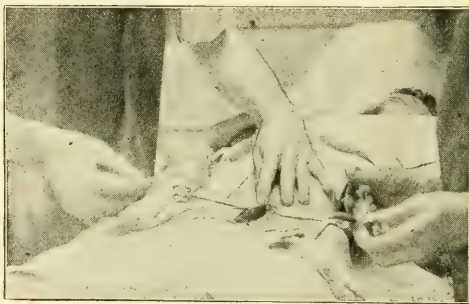


Fig. 819.
Incision Down to Peritoneum.

for the different layers, nor should there be any hesitancy till the fat overlying the peritoneum is encountered. This is to be picked up between two pairs of heavy, rat-toothed dissecting forceps and incised carefully till



Fig. 820.
Peritoneum Raised and Knicked with Knife
Turned Somewhat Flatwise.

the peritoneum is reached. Then after applying hemostats to the bleeding points the peritoneum is picked up, drawn well upward away from intestines and omentum and slightly nicked between the forceps with the knife turned somewhat flatwise. (See Fig. 820). The smallest nick is sufficient to allow the air to enter and cause the intestines to drop away from the opening, which can then be quickly and safely enlarged. No grooved director is required. As soon as this

small opening is made, the corner of the scalpel handle is made to enter and enlarge it, the finger then enters, the knife is laid aside and one blade

of the long angular or straight blunt-pointed scissors is passed under the peritoneum, its back resting upon the palmar surface of the forefinger or between two of the fingers, and the peritoneum and overlying structures are cut through at a single stroke. (Fig. 821). The incision is usually enlarged downward first, cautiously, so as to avoid wounding the bladder; then upward. Broad T forceps may be applied to the

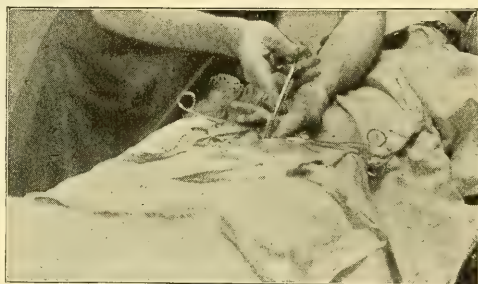


Fig. 821.
Enlarging Incision Downward.

margins of the peritoneum and allowed to lie upon the abdomen. This is not necessary, but facilitates the introduction of the fingers or hand by keeping the peritoneum everted. Moreover, it prevents the peritoneum from being stripped from the overlying structures, besides—an item of some import—taking the place, to a considerable extent, of retractors, and aiding materially in the final coaptation and suturing of the peritoneum.

It is hardly necessary, perhaps, to here again emphasize the fact that upon the surgically perfect preparation of the patient prior to the operation the success of the undertaking largely depends. So much stress has been laid upon the importance of preliminary steps in any and all operations that insistence will be omitted here. Proper preparation and anesthetization will be potent factors in the prevention of any trouble from protruding intestines. If the patient has been properly prepared and thorough muscular relaxation has been obtained by the anesthetic there should be no trouble from this cause; if the intestines do protrude they must be returned or allowed to lie outside wrapped in warm sterilized towels, sponges or gauze pads, which should be changed from time to time in order to prevent chilling.

LIGATION. Two or more fingers are introduced into the uterine fundus and thence are swept laterally along the broad ligament till the ovary is reached, which is then brought well up into or out of the wound,

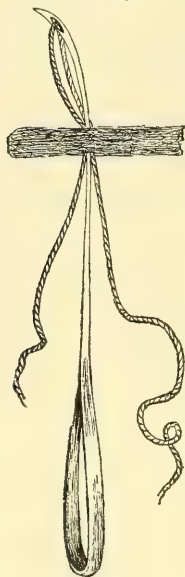


Fig. 823.
Pedicle Needle,
Fixing Pedicle.
Silk Loop is to be
Caught near Needle
Point and Needle
Withdrawn.

where it may be held by the fingers or a suitable pedicle forceps. Sometimes this can be done easily; at other times it will be impossible, on account of thickened or short broad ligament. A curved pedicle needle or aneurism needle, doubly armed with heavy braided silk, is made to pierce the median portion of the ovarian pedicle a little below the gland. (See Figure 823). The loop of silk being pushed through is caught on the other side, the needle withdrawn, and the loop cut, crossed and tied around the pedicle in the form of a figure eight. (See Figure 822). It is

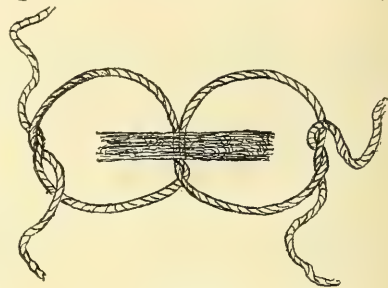


Fig. 822.
Showing Loop Cut, Threads Crossed
and Ready to Tie in Figure-of-Eight.

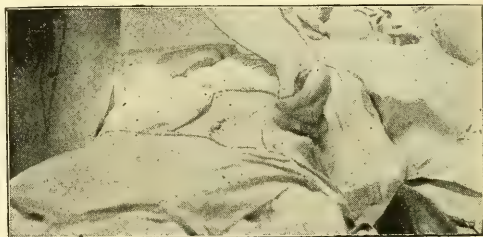


Fig. 824.
Abdominal Wound Closed with Silk Worm
Sutures, which are left long.

customary to exercise great care to see that the loop is crossed, so that when tied one loop is caught within the other. The author does not regard this as necessary, as personal experience has shown that the first loop may be disarranged or loosened by the strain upon it from the tying of the second. As the knot is being tied the pedicle should be relaxed. Some care should be exercised in cutting the pedicle to see that sufficient



Fig. 825.
Ovary and Tube held up by Assistant while
Ligature is Applied.

insure against its slipping. If the pedicle is quite slender it may not be necessary to transfix it, but a single loop may be thrown around the whole and securely tied. Transfixion, however, decreases the probability of slipping, although this is quite remote in a tightly-drawn ligature applied to a lengthy and slender pedicle. As the pedicle is partially severed it may be grasped with forceps in order that it may be held and inspected as it is lowered into the abdomen. Greater care is

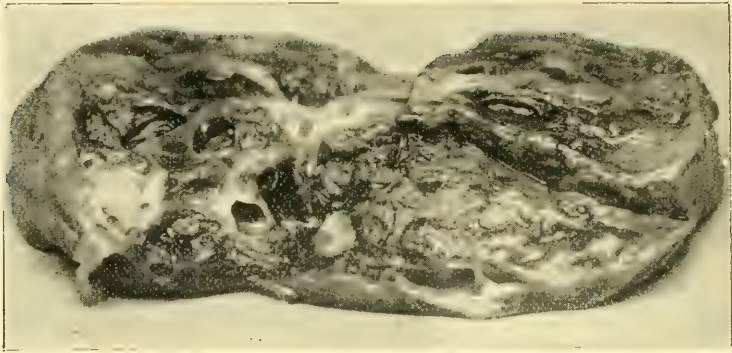


Figure 1. Thyroidectomy. Cysts and Calcareous Degeneration of Partition Walls.—Lee.

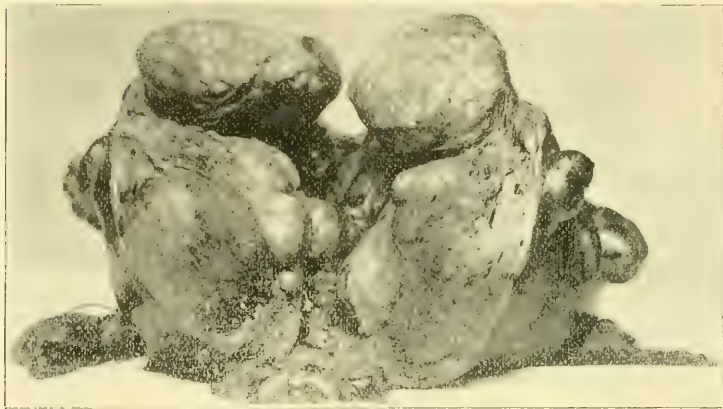


Figure 2. Fibro-Myoma with Sub-Peritoneal, Interstitial and Sub-Mucous Bosses. Vagino-Abdominal Hysterectomy.—Lee.



Figure 3. Sub-Mucous Fibroids and Fibroid Polypi. Vagino-Abdominal Hysterectomy.—Lee.

necessary in the ligation of short or broad pedicles. Such may require the triple loop or continuous ligature. (Figs. 826 and 827). Instead of the figure of eight ligature some prefer the Staffordshire and others Bantock's knot, both of which transfix the pedicle and require the tying of only one knot. (Figs. 828 and 829.) If the tube is to be removed

with the ovary the double, and at times the triple-linked, knot is required.

TOILET OF PERITONEUM. The next step is the toilet of the peritoneum. The wound and intestines are wiped carefully with sterilized wipers and a small one, in a sponge-holder or dressing forceps, is carefully guided downward into the retro-uterine pouch where the blood naturally gravitates. This is wiped out till the wiper comes out quite free from blood. Of course drainage will not be thought of after an uncomplicated operation like the above. The omentum is next drawn down smoothly and a flat sponge or gauze pad laid over it and beneath the abdominal parietes, to catch the blood which escapes from the suture holes in the peritoneum.

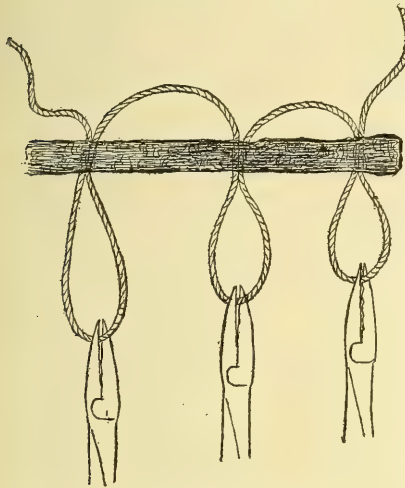


Fig. 826.

Continuous Chain or Interlocked Suture Introduced.

There are various methods of uniting the wound. The simplest is by one row of silk-worm sutures introduced through skin, muscles and peritoneum on one side, then made to emerge through the same structures of the opposite side. This may be accomplished by the needle already mentioned in enumerating the necessary instruments. Beginning at the pubic end of the wound, the needle is made to penetrate the abdominal wall on one side,

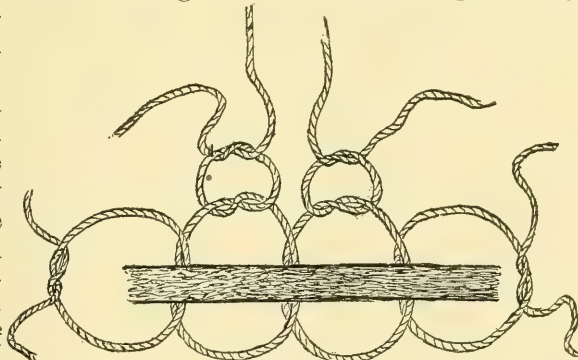


Fig. 827.

Same as Figure 826. Loops Cut and Ready to Tie.

(about one-half inch from its margin) from without inward and is then pushed through the other side from within outward. The assistant, standing on the opposite side, quickly introduces the end of a silk-worm suture which is pulled through the abdominal wall as the needle

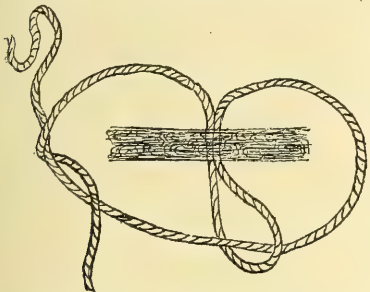


Fig 828. Bantock's Knot Ready to Tie.

These are inserted about one-half- or five-eighths of an

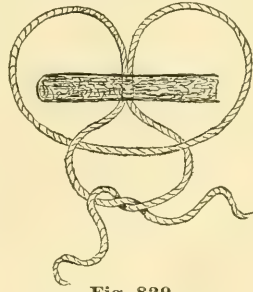


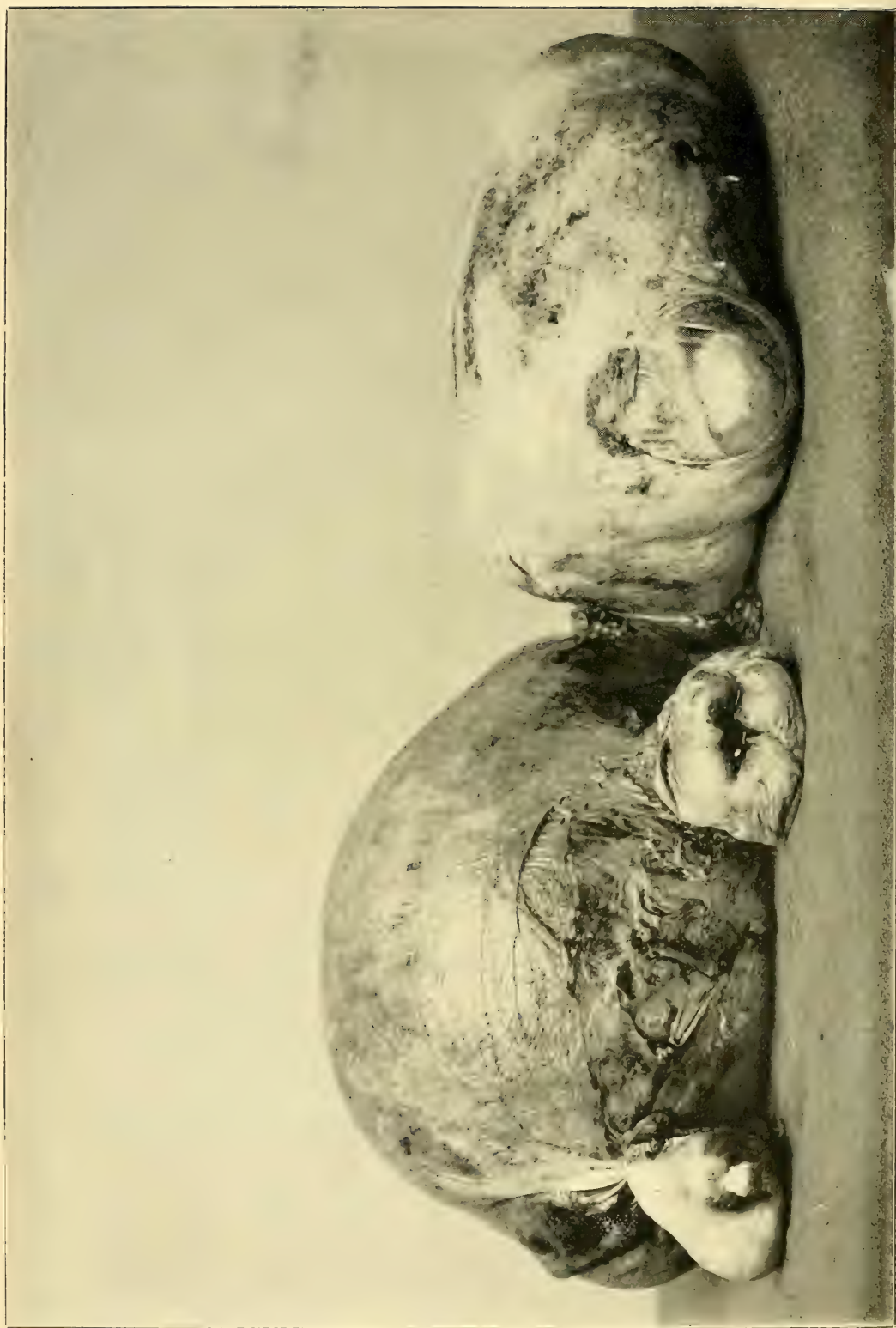
Fig. 829.
Staffordshire Knot.

inch apart, the ends being held in T forceps to prevent them from being accidentally drawn out during the manipulations necessary in the introduction of others.

After all are introduced and the ends held firmly in the T forceps the middle sutures are separated upward and downward and the gauze pad removed. The omentum is again smoothed down, the wound surfaces wiped, the sponges and instruments counted and the sutures tied from below upward. The pressure of the apposing muscular surfaces usually checks whatever oozing there may be. If there is gaping or pouting between the sutures superficial sheep-gut sutures may be introduced. The skin is next thoroughly wiped, iodoform or other antiseptic application is used or not, according to preference, the silk-worm sutures are left long and laid within the iodoform-gauze which is placed over the wound. Some absorbent cotton may next be laid over the gauze, three or four adhesive strips made to cross this from well down beside the hips, and an abdominal binder pinned snugly over all. Usually the wound will require no dressing till the sutures are to be removed, which will be in about ten days or two weeks. This is a simple, rapid and fairly satisfactory method of uniting the wound. Much the same thing is accomplished by having two long, straight needles on each silk-worm suture and pushing one through each side of the wound from within, outward. When the patient's condition will permit, or when there is reason to fear subsequent ventral hernia, the wound may be more securely coapted by two or more tiers of buried sutures. The first consists of a running sheep-gut or silk suture, introduced with a full curved Hagedorn needle; the next tier consists of silk-worm suture, introduced in the same way to unite the muscular surfaces and fascia. These are tied, cut short and left buried. An extra tier may be employed, if deemed advisable, for bringing the fascia or adipose layer together. The skin may be united by interrupted superficial sheep-gut suture, or by the running subcuticular stitch of silk. There is much less pain attending this latter method of uniting the wound, and it also has the advantage of requiring practically no post-operative dressing, as there are no sutures to remove and much less danger of stitch abscess than when the skin is pierced. For after-treatment see page 1312.

In from two to three weeks the patient may be allowed to leave her bed, with the abdomen well supported. An abdominal supporter, with a pad to rest against the site of the incision, may wisely be worn from two to six months.

For the removal of small or medium-sized tumors of the ovary there need be little or no deviation from the foregoing plan of performing ovariectomy. In the case of large tumors, adhesions or abscess, modifications in technique are necessary.



Fibro-Myoma Complicated by Double Ovarian Cyst — 1 ea

CHAPTER VII.

OVARIAN TUMORS.

Solid Tumors of the Ovary.—These consist of fibro-myomata, sarcomata and carcinomata. It has been estimated that not more than five per cent. of ovarian tumors are solid.

Inasmuch as they are of somewhat rare occurrence and their symptoms are in many respects similar to ovarian growths of greater frequency, the treatment of which consists of extirpation with practically the same procedure, the operative technique will be given with the latter class of tumors.

Cysts.—These occur in almost any part of the ovary. They are variously classified and

divided; some of the varieties being dermoid, papillary, "proligerous," areolar, cysts of the corpus luteum, follicular cysts, and tubo-ovarian cysts. Whether a cyst be of one variety or the other, —oöphoritic, paroöphoritic or parovarian—makes but little

difference so far as operative surgery is concerned. Prolonged description of the different varieties, their etiology and pathology, belong more particularly to special works on gynecology. Let it suffice that ovarian cysts are found in infancy, in adult life and in advanced age. They vary in size from that of a pin's head to the utmost capacity of a distended abdominal cavity, and contain varying quantities of fluid from a drop to two, four, and even ten or more gallons. The fluid is as variable as the size.

Fig. 831.
Typical Ovarian Cyst—Ovoid.

It is thin and limpid or thick, tenacious or grumous. It may be contained in one large sac (unilocular cyst), or the tumor may be divided by partitions (multilocular cyst.) In the dermoid cyst teeth, hair, bone, nails, sebaceous glands, etc., are found. Cheesy or pultaceous masses of sebum and epithelial debris are also characteristic. This variety is dangerous, in that spontaneous or accidental rupture is quite likely to be followed by fatal peritonitis.



Fig. 830. Large Ovarian Cyst.
—Macdonald.

SYMPTOMS. While the tumor is small it usually escapes notice, although it may be preceded by a history of ovarian pain, pelvic discomfort and occasionally tenesmus of the bladder. It is often discovered by accident. Bimanual palpation may reveal a smooth, rounded or



Fig. 832.

Typical Ovarian Facies.

an enormous size and stretching and thinning the abdominal parietes markedly. The pain and distress are likewise aggravated. When the cyst is quite large the pressure-symptoms manifest themselves through the impaired digestion, renal involvement from ureteral compression, dyspnea, cardiac impairment, edema and varicose veins of the lower limbs, and, in extreme cases, emaciation, exhaustion and uremia.

DIAGNOSIS. When the cyst is small and lying in the pelvis it will be diagnosed by bimanual palpation as above referred to. Fluctuation may not be discoverable while the tumor remains of small size. As to situation, such a cyst is found more frequently in Douglas' cul-de-sac than in any other position. It is not usually sensitive to the touch.

If the cyst is large the patient should lie upon the back with the abdomen exposed, when the lower portion of the abdominal parietes are seen to be distended rather abruptly. (Fig. 833). It usually appears to be in the median line, but upon close inspection may be found slightly less prominent on one side than the other. It may be single, unilocular, multiple or multilocular. In the former case it will be soft, smooth, globular and fluctuating; in the latter it will be somewhat firmer and irregular. It is quite mobile in all directions. The tumor as a whole is dull on percussion. Sometimes it attains an enormous size.

oval mass, sometimes in the pre- or retro-uterine space, and at other times lying on one side of the fundus uteri. It is generally quite movable. When it becomes large enough to rise above the pelvis pressure symptoms become more prominent and the enlargement of the abdomen becomes visible. Early in this period the patient sometimes discovers the tumor herself. The distension increases rapidly in some cases, slowly in others, but frequently reaching



Fig. 833.

Large Ovarian Cyst, Showing Point of Prominence as Compared with Uterine Fibroid.—Wilcox Hospital.

Lee, of Rochester, reports the recovery of a patient after the removal of an eighty pound cyst and another case with a tumor equally large dying without operation. The first case had suffered from ovarian cyst for six years. She had received opinions from competent physicians as to her condition, but although operation was frequently advised would not have it performed, until the pressure and exhaustion were so great that she was unable to longer stand the suffering. When she arrived at Rochester she was in such an exhausted condition that it was with great difficulty that she reached the hospital. She slept in her chair two hours during the night, and was prepared for operation at ten o'clock the next morning. Although the organs were sound she suffered from general dropsy due to pressure. Her feet and legs were swollen to about twice their natural size, and her trunk and the tissues of even her face were very edematous. The distension of the abdomen was immense. (Fig. 834.)

She had not lain down for many months,

as the pressure on the lungs caused great embarrassment to respiration. On account of this condition and extreme weakness, ether was not at first employed, but cocaine was injected into the abdominal tissues and the incision made, with the patient in a reclining posture, she suffering no pain therefrom. The abdominal walls were



Fig. 834.

Eighty-pound Ovarian Cyst—Recovery—Operation in part under Cocaine Anesthesia, in Reclining Posture.—Lee.

very thick and edematous, and the water ran out of the tissues to form a large stream at the lower angle of the wound. When the tumor was reached it was found to be adherent to the parietes from the bladder to the diaphragm above and the flanks on each side. It was tapped, and as pain attended the necessary steps of the operation the patient was laid on the table and given ether, while the adhesions were separated and the summit of the tumor was reached. At this point the gangrenous sac gave way and discharged the balance of the fluid into the cavity of the abdomen. The abdomen was quickly flushed out with sterile water and closed with good drainage. She was collapsed during the operation, and because the sphincter was so relaxed that the rectum would not retain stimulants brandy was administered hypodermically. The tumor weighed eighty pounds and its removal consumed forty minutes. The patient quickly rallied and when carried from the recovery room her pulse was only 112, respiration 40, and temperature 98 degrees Fahr. During the evening of the first day the pulse ran up to 138, was small and feeble, and the abdomen began to distend rapidly. The patient could not retain rectal enemata, therefore it became necessary to give her three-quarters of an ounce of Epsom salts, which quickly started the peristalsis and large quantities of gas were expelled. This was the most critical moment in the case, as the condition probably would have gone on to septic peritonitis

but for this simple expedient, which served to change the case from an unsuccessful to a most fortunate result. Digitalis, in tincture, was given internally, and as soon as the patient gained sufficient control of the sphincter, nutritive enemata were prescribed, and beef juice was given by the mouth. For the next four days she passed four hundred and fifty-one ounces of urine, or one hundred and twelve and three-quarter ounces during each twenty-four hours. General dropsy rapidly disappeared, the appetite and strength improved, the pulse, which was weak and ranged from 130 to 144, became much stronger, and there was general improvement.



Fig. 835.

Enormous Ovarian Cyst. Patient moribund when seen. Abdomen five feet six inches in circumference. Thigh, three feet six inches.

The second case referred to was moribund when first seen. Her thighs measured three and a half feet each, and her abdomen was five and a half feet in circumference. (Fig. 835). She was delirious and in collapse when the photograph from which the cut was made was taken, at twilight. Had she lived through the night she would have been operated upon as soon as daylight could have been had.

THE DIFFERENTIAL DIAGNOSIS

OF SMALL CYSTS OF BROAD LIGAMENT.

Cysts. These are in close apposition to the lateral borders of the uterus and lack the mobility and spheroidal outlines of the non-adherent ovarian cyst.

Fibroid Growths. These are usually distinguishable by the firm feel, although the dermoid cyst may also present a sensation of firmness to the finger.

Hydrosalpinx. This growth is generally oblong instead of globular, lies nearer the uterus, is likely to be less movable than the ovarian cyst and a history of pelvic inflammation may be elicited.

Pyosalpinx. It presents a history of acute pelvic inflammation, is quite sensitive to the touch, is surrounded by adhesions and inflammatory exudate, and may be attended by marked febrile symptoms.

Hematosalpinx. This generally comes rather suddenly, is more immovable and lies laterally to the uterus, and is associated with tubal pregnancy.

Retroflexed Uterus. Inasmuch as Douglas' cul-de-sac is the favorite position for small ovarian cysts it is but natural that the uterine fundus, when retroflexed, should be mistaken for the cyst. The careful introduction of the uterine sound, with combined manipulation to show that the fundus is absent from its normal position, removes all doubt.

DIFFERENTIAL DIAGNOSIS OF LARGE OVARIAN CYSTS FROM DISTENDED URINARY BLADDER. In all cases of fluctuating abdominal or pelvic tumors a catheter should be introduced. The bladder has frequently been mistaken for a cyst.

Ascites. This presents a flattened abdomen, while the cyst raises the abdominal wall and maintains a more spherical outline (Fig. 836), is more resistant, and its uppermost surface is flat on percussion. The summit of the ascitic abdomen is resonant, and the level of the fluid changes with the change in position. Heart, renal and hepatic lesions may be found associated with ascites. Ascites is often found associated with and dependent upon the presence of cysts or other abdominal or pelvic tumors.

Pregnancy. More than one abdominal surgeon has opened the abdomen for a supposed cyst and found a pregnant uterus. To exclude pregnancy the history must be considered intelligently. The concomitant signs and symptoms must be looked for—suppressed menstruation, morning sickness, changes in the breasts, and improvement in general health and appearance. The pregnant uterus generally increases in size more rapidly than a cyst, the cervix is softened and congested, and fetal heart sounds and fetal motion at certain periods make the diagnosis clear. Pregnancy and ovarian cysts sometimes coexist. If the surgeon should be unable to arrive at a satisfactory conclusion he may withhold his opinion and re-examine the patient at intervals of three or more weeks; time will aid materially in removing his doubts as to the nature of the tumor.

Hydramnios. This may simulate an ovarian cyst but is situated in the median line, appears suddenly and is preceded by and associated with pregnancy.

Ectopic Gestation. This is a little more difficult to exclude, but on the whole it were no great misfortune to mistake this condition for a cyst as it imperatively demands an abdominal section. The patient presents all the symptoms of pregnancy, but this swelling is not in the median line and lies at the side or behind the uterus.

Fibro-Cystic Tumors. These are usually of slower growth, firmer to the feel and, if uterine, are likely to be attended with menorrhagia and the cervix may be found drawn upward.

Hydro-Nephrosis. It is easily excluded if somewhat acute and following a marked diminution in the amount of urine excreted, or if the size varies synchronously with the variations in the quantity of urine voided. It grows from behind downward, is less mobile than the ovarian cyst, and usually the colon can be found lying upon it. When percussed its flat note can be elicited well down into the flank toward the spine.

Obese and Pendulous Abdomen. Its development is generally slow and is associated with the development and



Fig. 836.
Large Ovarian Cyst.—Butler.

deposit of fat more or less symmetrically over the whole body. This is in marked contrast to a large abdominal cyst, which is usually associated with emaciation.

For the comfort of the beginner, and occasionally for the man of experience, it may be added that among the various lesions just differentiated

from ovarian cyst six only need cause any mental disquiet when mistaken for such a cyst. These are as follows:—A distended bladder, a retroflexed uterus, intra-uterine pregnancy, hydramnios, obesity and ascites. For all the other lesions an abdominal section is almost—and in some cases quite—as permissible as for an ovarian cyst.

COURSE AND COMPLICATIONS. The pressure-symptoms have already been alluded to. Twisting of the pedicle is not an infrequent occurrence. It is presumed that exercise, motion and intestinal peristalsis are responsible for this accident. The pedicle may be subjected to only a partial turn but in some instances it has been found twisted several times. Of course the short, stout pedicle is not so likely to be twisted as when long and slender. Such torsion may be so sudden and tense as to interfere with the circulation. Naturally the venous current suffers first. The cyst is engorged, serum and blood are exuded and necrosis is the result. Instead of necrosis, atrophy of the tumor may result when the torsion occurs slowly and gradually diminishes the blood supply to the tumor. The symptoms of acute torsion are sudden and severe abdominal pain, at times attended with shock, an increase in the size and change in the position of the tumor. Hemorrhage may be associated. These symptoms resemble tubal pregnancy and rupture, but differential diagnosis is not essential, as both demand abdominal section. If the woman had previously manifested signs and symptoms of pregnancy the sudden onset of the above symptoms indicate ectopic gestation and rupture; if she were known to have an ovarian tumor they indicate torsion of its pedicle.

Adhesions are supposed to be due to irritation and inflammation, provoking a plastic exudate between the apposing surfaces, and fibrous bands or sessile adhesions result. They may be slight or extensive and always lend an additional element of danger. Elongated bands of adhesion are due to the stretching from motion and weight. Over and around such bands the bowel may become kinked, twisted or strangulated. The short adhesions are sometimes difficult and dangerous to overcome, especially when attached to the pelvic peritoneum overlying the numerous and important vessels. Omental adhesions are quite likely to be extremely vascular.

Suppuration occurs frequently through adhesions which are infected from the bowel, bladder or Fallopian tube. It has followed tapping. Dermoid cysts, from the nature of their contents, are dangerously prone to suppurate, are attended with the usual systemic manifestations of peritoneal sepsis, and the surgeon should be suspicious of any and all such manifestations occurring in a patient previously known to have a cyst.

Rupture may occur from gradually increased pressure and thinning of the wall or it may be caused by falls, jars, or blows. They most frequently rupture into the peritoneal cavity but are known to empty themselves into the bowel, bladder, uterus etc., to which they have become attached. A unilocular thin-walled cyst often ruptures into the peritoneal cavity with no attending symptoms save frequent and profuse urination and disappearance of the tumor. It is likely to refill. In the other varieties of cysts, e. g., dermoids, multilocular, or papillary, fatal peritonitis is not uncommon after rupture.

Hemorrhage may be slight or profuse and is the result of torsion,

rupture of the sac, or of enlarged vessels. It has been produced by tapping.

PROGNOSIS. From a study of the pressure symptoms and the course and complications of ovarian cysts it will be evident that, in general, the prognosis is unfavorable without the aid of operative surgery.

TREATMENT. A symptomatic prescription cannot be regarded as very efficacious, because when administered according to the totality of the symptoms it will be based on the pressure symptoms, and, therefore, upon mechanical influences instead of disease symptoms, which are obscured or are nil. It is unfair to therapeutics to expect it to operate against such odds. The spontaneous rupture and temporary disappearance of the cyst during the administration of some remedy is probably responsible for some confusion that may exist regarding the supposed action of such remedy, and the prescriber wonders why the cyst which has refilled does not again subside with the administration of the same medicine. *Lycopodium, apis, calcarea carbonica, apocynum, sulphur,* and *silicia* are frequently administered.

TAPPING. This procedure is to be roundly condemned as belonging to the surgery of the past, and having no place in the daylight surgery of the present. It might be possible to conceive of an extreme case of exhaustion, or a cyst associated possibly with pregnancy, in which tapping might appear justifiable in order to avert dissolution threatening from pressure, but it should be attended with full preparations for a laparotomy. In the opinion of the author tapping is more dangerous and far less efficacious than a properly performed abdominal section.

EXTIRPATION, OR OVARIECTOMY. This is the only treatment to be relied upon for prompt and permanent relief.

The arrangements are the same as for a simple castration, already described, with the exception of provision for the possible necessity of more instruments and a Trendelenberg frame. The additional instruments will consist of an increased number of ordinary hemostatic forceps, heavy pedicle forceps, cyst or sac forceps, a trochar and retractors. It is always well, when convenient, to have a small electric light within reach. The Paquelin cautery has been suggested before.

The sponges, forceps, etc., should be counted before operation and just before closure of the abdominal wound. More than one experienced operator has left an object of this kind in the abdominal cavity.

The steps of the operation for simple castration need not be modified till the abdomen is opened, when the glistening surface of the cyst appears. The fingers are introduced and swept about to outline the contour of the tumor and to note the presence or absence of adhesions. If the cysts does not bulge into the gaping abdominal wound an assistant should be instructed to make pressure on the upper or lateral portion of the abdominal walls. Then

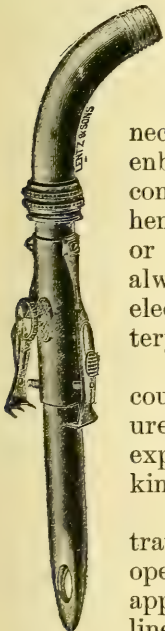


Fig. 837.
Tait's
Trochar.

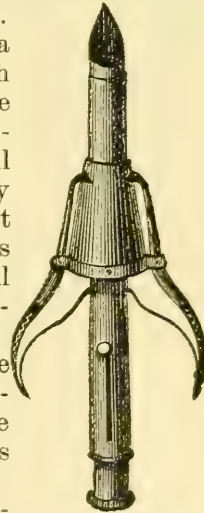


Fig. 838.
Spencer-Wells
Trochar.

a trochar is plunged through the cyst wall and its contents evacuated, while the assistant continues to make pressure upon the abdomen. As the cyst walls become relaxed they are caught by sac forceps and held well up in the wound to prevent the fluid from escaping into the peritoneal cavity. If preferred, the patient may be turned upon her side. The wound may be surrounded by sponges or pads to protect the abdominal cavity and its contents. If the cyst is multilocular the trochar must be plunged through one partition and then another till the several loculi are empty. During this procedure it is well to have one hand within the abdomen to provide against the trochar penetrating the cyst wall and wounding other structures. Or, the hand may be passed into the sac and the

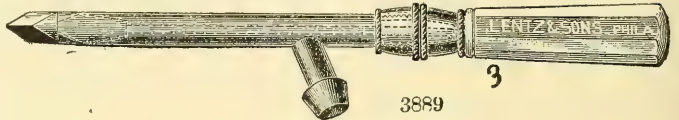


Fig. 839.
Emmett's Trochar.

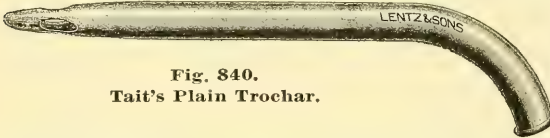


Fig. 840.
Tait's Plain Trochar.

men to provide against the trochar penetrating the cyst wall and wounding other structures. Or, the hand may be passed into the sac and the

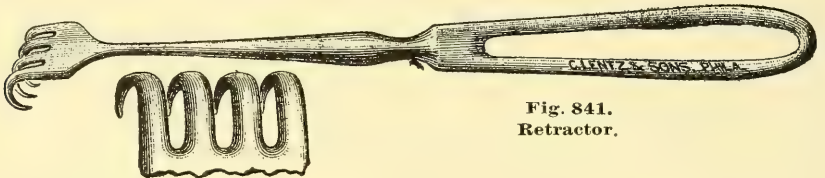


Fig. 841.
Retractor.

septi broken through with the fingers. Sometimes the sac contains a thick, sticky and tenacious substance that will not run through the trochar, and requires that the patient be turned upon her side and the hand introduced and used as a scoop to

evacuate the cyst. If this is very tedious, and if the cyst is dermoid or is suppurating, it is probably better to make a much larger incision and remove the tumor without evacuation. Ordinarily this is not necessary and a very large cyst may be removed through a small incision. As the sac collapses it is drawn out of the abdomen, its contents poured out and its

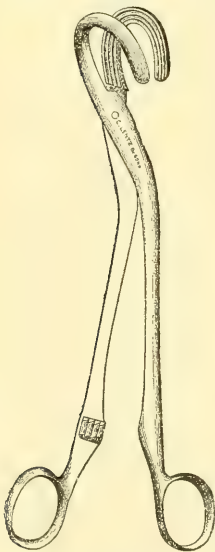


Fig. 842.
Cyst Forcep.

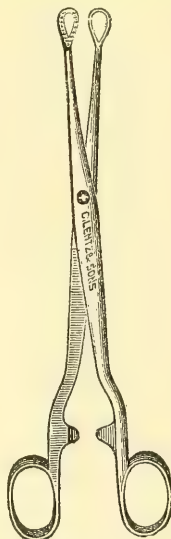


Fig. 843.
Dressing Forcep.

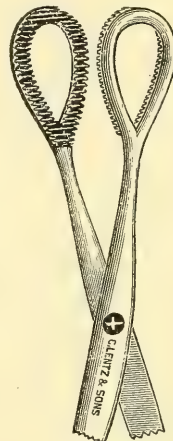


Fig. 844.
Cyst Forcep.

pedicle examined. (Fig. 845). It will usually be found to consist of a portion of the broad ligament, the ovarian ligament, and sometimes the Fallopian tube. Its treatment is the same as described under ablation

of the ovaries. The intra-peritoneal method is the only one to be thought of in the treatment of such a pedicle.

MANAGEMENT OF ADHESIONS. If not extensive these can often be seen and manipulated much more effectively after the evacuation of the



Fig. 845.
Ligating of Sac of Large Ovarian Cyst.

cyst. Recent adhesions give but little trouble and are readily separated. When older they may require some force to tear them with the fingers, and at times demand the use of scissors or knife. Partial adhesions are usually separated by sweeping the fingers between the wall of the cyst and abdomen. If very dense they may be cut, after being doubly ligated. Omental adhesions often contain widely distended vessels and should be cut between two ligatures. If the vessels are not very much enlarged efforts may be made to strip the omentum gently from the tumor wall, when it should be carefully examined, and if bleeding it will require ligatures or a few sheep-gut sutures. Adhesions between the pelvic peritoneum require a free incision, the elevated hip or Trendelenberg position, and the most patient and watchful manipulations. Adhesions to the bowel, liver, stomach, gall-bladder or urinary bladder must be separated with caution. If long, they present but little difficulty; but when broad and close it may be wise to cut out the attached portion of the cyst wall and leave it, after stripping off its lining membrane to prevent its further secretion. When the adherent viscera are separated the raw surfaces which are stripped off the peritoneum may be diminished or obliterated by fine suturing and drawing the peritoneal margins of the wound together. If adhesions are numerous and extensive or if there is a matting together of the abdominal contents the operator has a tedious task. Sight and touch must be employed. The fingers are made to do most of the work of separation, working first in one place, then in another and always striving to identify the anatomical structures as they are being manipulated.

If the raw surfaces ooze persistently they may be touched gently with the cautery point, heated dark red. Some use Monsel's solution for the same purpose. The end of the ovarian stump may be touched with the cautery, especially if it contains a tube which is suspicious. Or the end of the tube alone may be touched with the cautery or pure carbolic acid. If a papillary cyst or a suppurating ovary or pus tube is found, the broad ligament is likely to be shortened and there is much general matting together of the structures and a pedicle may be absent. In such a case the sac may be opened, after shutting off the abdomen and its contents, washed out, and stitched to the abdominal wound, packed with iodoform-gauze and allowed to heal from the bottom. Or they may be operated by two stages, i. e. leaving the packing down to the tumor for

about three days, when it may be removed; the intestines will have been walled off and through this track, surrounded by a wall of exudate, the tumor may be evacuated. (For the further treatment of abscesses and cysts within the abdominal cavity, with their treatment by packing and drainage, care of the drainage tube, etc., see Section on Surgery of the Liver.)

After removal of the cysts the other ovary should be examined and if diseased it should be removed. If only a portion of it is diseased and the patient desires progeny only the diseased portion should be removed, the bleeding points ligated and the edges of the margins of the raw surfaces brought together by fine sutures. The author has found such treatment successful in a woman, pregnant several months, who carried the fetus to full term and subsequently bore another child, demonstrating the function in the ovarian remnant.

AFTER-TREATMENT. For treatment of shock and after-effects of anesthetics the student should peruse those two subjects, in which rectal feeding and the treatment of vomiting are discussed. It need scarcely be insisted upon that the patient must be kept quiet, protected from visiting friends and relatives, and have the constant watchfulness of a thoroughly trained nurse, night and day, for from two to five days. If the urine cannot be voided at will it must be drawn every five hours. On no account should the patient be allowed to assume a sitting posture.

Hemorrhage into the peritoneal cavity may manifest itself during reaction, when the stronger cardiac impulse may force a coagulum from a vessel, or it may be the result of a ligature having slipped. The symptoms of hemorrhage therefore demand the re-opening of the abdomen and the finding and securing of the bleeding vessel. But little nourishment is administered by the mouth for the first twenty-four or forty-eight hours, and sometimes none if there are much nausea and retching. In such cases the patient is fed by rectal enemata. Occasional sips of water, champagne, ginger-ale or Vichy may be permitted, to estimate the tolerance of the stomach, but should be discontinued if they increase the vomiting. When this is intractable, relief is sometimes afforded by allowing the patient to swallow some fluid, which is to be raised with each attack of retching. If the thirst is intense it will be much relieved by free enemata of warm water. Some operators give no nourishment nor even a sip of water for twenty-four or forty-eight hours; but the author's belief is that it should be the rule to give patients rectal nourishment in from five to twelve hours after operation and continue it systematically every four hours till the stomach resumes its function. If this is done the vital forces are sustained and better able to withstand a possible attack of peritonitis, cardiac failure or any complication that may arise. When the stomach is found to tolerate water an occasional sip of nourishing fluid may be tried. This may consist of broths, beef tea, peptonized milk, buttermilk, liquid peptonoids, grape-juice, etc., varying somewhat with the preference and condition of the patient. From the second to the fifth day the usual sick-room semi-fluids may be tried, and, if tolerated, will soon give way for regular and generous diet.

It is important that the bowels should be moved. Only those who have watched the post-operative course of abdominal cases can appreciate the importance of this. Call it "entero-sepsis," "auto-sepsis," "intestinal

resorption," or what the surgeon will, there is no longer any question that the pent-up intestinal contents encourage or invite post-operative sepsis and that in the same proportion free intestinal evacuation has a favorable influence upon the irritable and rapid pulse, the foul tongue, elevated temperature and tympanites so frequently seen. This subject is pursued further in the chapters on Surgery of the Liver, etc.

The dressings under ordinary circumstances need not be disturbed for a week or ten days or more, when the stitches are to be removed.

The dressing, removal of stitches, treatment of stitch inflammation or suppuration, etc., is described in the chapter on antiseptics.

SALPINGO-OÖPHORECTOMY. Ablation of the ovaries and tubes for uterine fibroids or myomata is resorted to where myomectomy and hysterectomy are contraindicated or impossible. This is performed by passing the double ligature through the broad ligature close to the uterine cornu and tying as before directed. A blunt needle should be employed because the vessels are usually distended enormously. (Fig.



Fig. 846.—Blunt Needle.

846). No form of ligature is perfectly satisfactory in some of these cases, because of the character of the pedicle. The ligature requires the most careful adjusting to prevent its slipping. The vessels may require separate ligation, and sutures are often required to encircle and constrict bleeding vessels. The tubes, ovaries and the entire broad ligament are sometimes fused with the tumor, and castration or removal of the tubes is impossible; ligation of the ovarian arteries and hysterectomy are then indicated procedures. Neither castration nor ligation of the ovarian arteries is advised in cases of large uterine myoma, because of the danger of necrosis or embolism.

CHAPTER VIII.

THE FALLOPIAN TUBES.

Pathological Conditions.—The tubes may be congenitally abnormal and possess defective fimbriæ, may be shorter than normal, and occasionally are found strictured or occluded. This latter condition is generally the consequence of arrested development and extreme convolution.

Salpingitis.—Inflammation of the Fallopian tube is generally the result of varying degrees of puerperal sepsis or gonorrhœa. It is of frequent occurrence, and while it may apparently occur unassociated with either of the conditions just mentioned, it is certain that a coexistent endometritis can nearly always be demonstrated, and consequently the tubal involvement is regarded as secondary. The left tube is more frequently attacked than the right, but it is not uncommon for both to be involved, especially in cases of tuberculosis and malignant growths.

PATHOLOGY. This varies with the intensity of the inflammation, the location and structural limitations. The mucous membrane is first thickened and congested and hyper-secretion ensues. If this latter is excessive it accumulates in the tube, which is likely to be bent and convoluted, and is quite likely to become purulent and result in pyosalpinx, or simply increase in quantity and result in hydrosalpinx. If blood exudes into the tube it is known as hematosalpinx. The effusion may escape into the uterus and out through the vagina, or it is liable to escape into the peritoneal cavity through the fimbriæ, unless nature has been fortunate enough to seal their ends by means of protective inflammatory processes. This is not always accomplished and the results are variously known as peri-uterine inflammation, pelvic cellulitis, parametritis, perimetritis, ovarian abscess, pelvic peritonitis, etc. It is believed by some, however, that it is possible for infective material to be conveyed to the surrounding tissues through the lymphatics. The more intense the tubal inflammation the deeper and more extensive the invasion and the thicker the exudate thrown around the tubes and ovaries. The pelvic peritoneum and connective tissue are frequently involved and are characterized by general infiltration, thickening, hardening and matting together of the pelvic structures. The ovarian capsule becomes thickened, preventing the rupture of its follicles, so that in consequence, cystic changes are inaugurated later in the ovary. Instead of this the infection may be so virulent that the changes in the ovary are suppurative; and an ovarian abscess results. Sometimes the tubes are filled with pus which, accumulating and finding no exit, distends the tube into an enormous pus sac which is often evacuated as a pelvic abscess. Such an abscess may break in almost any direction—into the bowel, bladder, vagina, or peritoneal cavity. It is always a temporary relief, at least, if the tube becomes pervious at its uterine junction and the pus be evacuated, escaping through the vagina. Almost any such evacuation, whether it be intestinal,

inguinal or uterine, affords temporary relief, but recurring attacks are the rule. Like inflammation of other mucous surfaces, it may be mild in character and subside without involving the peri-structures, and with little or no permanent impairment of the tube. Repetition of such mild attacks begets chronic salpingitis, which may become suppurative and be characterized by periodical attacks and discharge of pus through the uterus and the vagina. Or, in some instances, the watery portions of the pus disappear and only a caseous mass remains. All varieties and degrees of inflammation of the pelvic organs may coexist—simple catarrhal inflammation of the tube, or an immense pyosalpinx, plastic peritoneal exudate with a moderate amount of adhesions, small or large abscesses, or both, with such a general agglutination of the pelvic contents that all normal anatomical detail is lost. Interstitial salpingitis is usually severe, because the tube is generally occluded; the fimbriae and ovary become firmly adherent and pelvic peritonitis is an associated complication.

SYMPTOMS. The symptoms necessarily vary according to the virulence of the attack and the associated structural involvement. Those of acute salpingitis are generally associated with inflammatory symptoms referable to the uterus, so that the clinician frequently has to deal with a utero-salpingitis.

With these there is not unfrequently an extension of the invasion to the ovaries, and then to the former are added the ovarian symptoms—the whole group indicating coincidental utero-salpingo-oöphoritis. The patient complains of pain in the region of the appendages, in the lumbar portion of the back, thighs and epigastrium. “Salpingeal colic” also occurs, perhaps followed by discharge of mucus, pus or both. There are usually tympanites and extreme sensitiveness over the ovaries and tubes; the finger in the vagina reveals a bulging, and the uterus and supra-vaginal structures are hard and unyielding, except when a large pus sac exists which will be detected by its soft, fluctuating feel. In examining the patient, with the aid of an anesthetic and sometimes without it, a bulging mass can be detected through the abdominal wall at the lateral borders of the uterus. The attack is ushered in and accompanied by chills, or chilly creeps and fever. Most pelvic inflammatory lesions are attended with constipation and disturbed menstruation unless the ovaries are more or less disorganized. The thickening, swelling and pressure with the attending pelvic congestion seem to encourage a profuse or frequent flow. Salpingitis does not necessarily lead to sterility, but its tendency is in that direction. A bilateral salpingitis with convoluted tubes, impaired cilia and more or less occluded fimbrial and uterine openings would probably explain the many cases of sterility among prostitutes who traffic in infection.

TUBERCULAR SALPINGITIS. This type possesses practically the same symptoms as those already described, but the previous history will be different. It is more likely to be distinguishable in a delicate woman with an elevated temperature in whom there is no history of gonorrhea or pregnancy and in whom there is detected a tuberculous tendency or a tuberculous lesion coexisting in some other organs or structures.

HEMATOSALPINX. This *per se*, may or may not be attended with

symptoms other than those due to the mechanical influences of the distension. Usually there is an associated peritoneal inflammation which presents a more prominent train of symptoms. Some believe that the lesion is invariably the attendant of tubal pregnancy.

HYDROSALPINX. Like the preceding affection, hydrosalpinx is likely to be largely dependent upon its associated pelvic inflammation for its symptoms, except such as are produced by the distension and pressure of the tumor, which may reach no inconsiderable size.

DIAGNOSIS. Clear-cut diagnostic distinctions between the numerous inflammatory pelvic disorders are often difficult or impossible because of their commingling. The previous history is to be carefully considered and if the patient has recently been confined, has aborted, or has been subjected, e. g., to some intra-uterine treatment, and the attending or subsequent symptoms indicate pelvic infection, a strong presumption of salpingitis is justifiable. An inferential diagnosis can frequently be made if the enumerated symptoms occur in a woman who is above suspicion, and who was recently married, or whose husband has recently returned after a somewhat prolonged absence and, although denying stoutly the existence of gonorrhea admits that he has a slight "leucorrhea," "gleet," or an innocent-looking urethral discharge. In other cases the woman may admit having had an attack of acute vaginitis or gonorrhea, or she may have been known to have suffered from a pre-existing endometritis. Much dependence is to be placed upon the physical signs obtained by conjoined manipulation, one or two fingers in the vagina easily detecting the immobile uterus and the board-like feel of the vaginal vault with the thick, hard, irregular or bulging masses. The elevated temperature is of considerable diagnostic value. The differential diagnosis has been studied under ovarian tumors.

PROGNOSIS. The milder cases may be expected to recover without much—and sometimes apparently without any—impairment of function, but the clinician will bear in mind that all inflammatory pelvic attacks are dangerously prone to invite recurrence. And yet the author, bearing this in mind, has sometimes been surprised at the freedom from after results and recurrences in severe cases subjected only to a necessitative evacuation. As already seen, sterility may ensue from impaired cilia which no longer convey the ovum to the uterus. Complete resolution takes place in some instances, the pus being evacuated in some of the directions already mentioned and the exudate becoming absorbed or organized. But the subsequent history of many of these patients is that of chronic invalidism, varying in degree; more or less constant pelvic distress, and repetitions of former attacks. The author has records of one patient whose sixth attack was followed by death in forty-eight hours, though there had been a respite of some months. Long-continued supuration with continuous flow from a badly drained pus sac is attended with chronic and gradually progressing septicemia, exhaustion and death.

PROPHYLACTIC TREATMENT. Much can be done in the way of prophylaxis when it is universally understood that dirty gynecological and obstetrical procedures are responsible for many of the attacks. The introduction of a dirty finger into the vagina or a dirty sound into the uterus may be the cause of an endometritis which extends to tubes, fimbriae, ovaries and pelvic structures generally. All cases of vaginitis and

endometritis must be treated, if not for the discomfort they cause then for their possible sequelae. The acute stage demands the temporary separation of man and wife, absolute rest in bed, free intestinal evacuation, hot compresses over the region of the appendages and copious vaginal douches administered three or four times a day. The medicines that are found useful are bryonia, belladonna, kali carbonicum, arsenicum, aconite, liliun tigrinum, rhus tox., arnica, pulsatilla, and colocynth. Some resort to anodynes for the excessive pain, but they should be avoided if possible because of the danger of blocking the bowels, for it is extremely important that they should act freely. When the acute symptoms begin to subside there should still be but little liberty allowed the patient. Relapses are so common from indiscretion that the patient should be kept in bed till the pain and tenderness have subsided. When considerable improvement has occurred vaginal wool tampons of boro-glyceride may be employed from one to three times a week, with the hope of aiding the depletion and absorption of the pelvic exudate. Some laud electricity for this purpose. When the tampons are removed the hot douches may still be administered. If the symptoms do not offer special indications for some other remedy sulphur, silicia or graphites may be employed to aid the absorbents. Sulphur 30x and 3x, in alternation every two or three hours, is the author's favorite prescription. The tampons may be continued with advantage even after the patient has regained her feet and is allowed to go about. The general health must be looked after carefully and the patient given the benefit of nourishing diet, good hygiene, and massage in selected cases. If endometritis exists the uterus should be curetted. Many cases seem to require no other treatment than the above, but when this fails to give relief, or when the condition assumes a chronic or sub-acute form with recurrences, other measures must be tried.

OPERATIVE TREATMENT. The passage of probes, or bougies, through the uterine cavity and into the Fallopian tubes has been recommended but has few advocates. If fluctuation can be detected the pus must be evacuated either through the vaginal vault posteriorly to the cervix, or by sub-peritoneal incision or by a combination of both. The abscess should always be evacuated through a surgical opening and never be allowed to break its own way out.

The evacuation through the vaginal vault is sometimes satisfactory and at other times quite the reverse. It is necessary to employ this method in some instances when the patient will not consent to or her condition will not permit of other operative procedures. In such a case the vagina is rendered as nearly aseptic as possible and fully exposed to view by retracting the perineum with a Dawson-Sims speculum. Then the vagina is mopped thoroughly with soap-suds and wads of cotton or gauze held in a pair of uterine dressing forceps. A final douche and swabbing with bichloride solution is next employed, the cervix is grasped with a pair of double tenaculum forceps and the vaginal vault incised in the post-cervical space. To aid in the removal of the contents the pus cavity may be irrigated through a good sized catheter, or a blunt curette may be used cautiously. A "T" or Trendelenberg drain is to be introduced and the cavity packed. The pus will generally be found extremely offensive, and irrigation is required daily and sometimes twice a day. It would seem that such an opening would provide excellent

drainage, but as intimated above, it is sometimes very unsatisfactory, and convalescence is extremely tedious and prolonged and attended with an erratic temperature curve and general symptoms of defective drainage.

The sub-peritoneal route is that often employed to ligate the iliac vessels. An incision is made just above the pubis, laterally to the bladder of course, and the connective tissue separated, the peritoneum raised, the abscess incised, evacuated, gently curetted and carefully examined for other collections of pus which may be emptied through the same opening. A counter opening may be made through the vaginal vault, a drainage tube, gauze packing, or both, introduced and frequent through-and-through irrigation employed. When there is no bulging pus sac discoverable and the symptoms are stubborn and unyielding, the abdominal cavity should be opened through the linea alba and the diseased tubes extirpated. The technique of this operation does not differ materially from that already studied in relation to extirpation of diseased ovaries. If the tubes contain pus they should, if possible, be removed without rupture. Every care should be exercised to avoid soiling the peritoneum, by surrounding the diseased structures with sponges or gauze pads, and should the pus escape while the tubes are being enucleated the abdominal cavity, and especially the pelvis, must be freely flushed with hot salt water. If adhesions have been broken up freely and there are many raw points these conditions, with the soiling of the peritoneum, demand drainage. The tubes should be removed close to the uterus, which sometimes demands curetting even after the appendages are removed. If there is a large pus sac it will be brought up into the wound, evacuated, stitched to the skin and packed. Or it may be operated by two stages, as previously suggested.

Even after operation some of these patients never recover perfect health. The suppurative process is checked but they do not rebound and a certain number are semi-invalids for life.

CHAPTER IX.

TUBAL PREGNANCY.

Ectopic Gestation—Extra-Uterine Pregnancy.—Etiologically and pathologically this subject is out of place in a work on general surgery.

Symptoms.—The unnatural position and circulation are not well calculated to insure long life to either ovum or fetus. Intra-tubal hemorrhage from the tubo-chorionic vessels (hematosalpinx) is a common occurrence and is likely to be repeated unless the first one causes the death of the ovum, thus preventing further growth and distension. The growth of the ovum causes distension of the tube, rupture and hemorrhage. From the third to the tenth or twelfth week the fetal mass is likely to escape from the tubal extremity or through other portions of the tube into the peritoneal cavity. Such an accident is usually attended with alarming symptoms of hemorrhage and shock. The mass with its rapidly accumulating blood clots may be felt in the retro-uterine space, where the blood naturally gravitates, forming a so-called hematocele. Sometimes the rupture in the tube is incomplete, the fetus is not extruded—or only partially so—and the hemorrhage may be continuous and rapidly fatal or may be characterized by repetitions till the patient becomes exsanguinated. Exceptionally the fetus may have attachments to the placenta, after escaping from the tube, and grow and go on to full term, attended by spurious labor.

Occasionally the rent in the tube is through its floor and the blood and fetal mass escape into the connective tissue of the broad ligament, forming a blood tumor or hematoma. The mass, whether in the broad ligament or peritoneal cavity, sometimes becomes encysted, much of it is resorbed and what remains may mummify, become calcified, or break down, suppurate and be discharged through the rectum, vagina, loin, etc.

Diagnosis.—The patient usually suffers so little inconvenience before rupture that diagnosis is often difficult or impossible. As the early symptoms are those characteristic of intra-uterine gestation the patient seldom presents herself for examination or affords an opportunity for diagnosis. Such a pregnancy is often preceded by a period of sterility, but this need not always be looked for, as ectopic gestation may occur soon after marriage. The menses are generally scant or absent, but in exceptional instances there is no omission of the menstrual flux.

PHYSICAL SIGNS. Previous to rupture of a distended tube these consist of a swelling which may be felt at the lateral border of the uterus. There may be some pain in this region. The cervix may be found softened and patulous and the uterus somewhat enlarged. The changes in the breast, the morning sickness, etc., are of importance.

DIAGNOSIS. At the time of rupture the diagnosis will be based upon the history and the sudden onset of sharp pain in the lower lateral portion of the abdomen, pallor, faintness, nausea or vomiting, cool, clammy

skin, small, rapid pulse, sub-normal temperature and perhaps unconsciousness. These are the symptoms of hemorrhage and shock. The patient may recover somewhat only to suffer from repeated attacks, any one of which may prove fatal. With these symptoms there may be found a soft, doughy mass of fluid or recently coagulated blood in the retro-uterine space. Or if the rupture has taken place between the layers of the broad ligament the resulting hematoma may be recognized by its somewhat firmer feel, the fact that it pushes the uterus forward and to one side, or the peritoneum upward to such an extent that it can be felt above the pubis. If situated upon the left side a rectal examination will aid in deciding the character and location of the swelling, which seems to constrict the rectum. The history, symptoms, and physical signs will generally enable the surgeon to exclude biliary or renal calculi, hydro- and pyosalpinx, and torsion of the pedicle of an ovarian tumor, etc.

TREATMENT. The proposed killing of the fetus by electricity has not received very general approval. Even though it succeeds in killing the fetus—which is not at all certain—the woman's life is still menaced, in a degree, by the remaining fetal mass. The recognized treatment is abdominal section and removal of the gravid tube and its accompanying ovary—the function of the latter being lost when the ovary is removed. Of course, the best and easiest time for operation is before rupture occurs. Intra-peritoneal rupture demands immediate preparation for an abdominal section. In the meantime such treatment is instituted as advised in the Section on Shock, with special reference to intra-venous saline infusion, and if this results in improvement which seems to be continuous, operation may be delayed until the patient has reacted, otherwise operation must be resorted to at once, as it offers the only chance of saving the woman's life. Except that the incision should be long the operation is practically the same as that already described, until the peritoneum is incised. This is usually followed by a free flow of blood. Then the next step is to find its source. This is generally the margin of the torn tube which is caught with pressure forceps, ligated and removed. Then all fluid blood, clots and shreds are flushed out by free irrigation with warm salt solution. There are usually adhesions, and the procedures required are similar to those in the operative treatment of inflammatory tubal affections. Drainage is frequently necessary. Many believe in omitting operation in cases of extra-peritoneal rupture or rupture into the broad ligament, except when there are repeated hemorrhages, when the mass suppurates, or when there are evidences of fetal growth. Not infrequently the mass suppurates, probably from its proximity to the rectum, and its clots and debris are evacuated through the vaginal vault. If the mass is large and rises well above the pelvis it must be reached through the abdominal route. A free incision is made over the tumor which lies to one side of the median line, the sac is incised and the fetus removed. The sac may be stitched to the abdominal wound and packed till the placenta comes away. Unless it is found loose at the time of operation its removal would be followed by exhausting hemorrhage. Even though the fetus is viable it is quite likely to be delicate, deformed and short lived.

CHAPTER X.

DISEASES OF THE BROAD LIGAMENTS.

Lesions.—There has been much confusion in relation to lesions of the broad ligaments. The previous study of the inflammatory affections of the tubes and ovaries has shown that peri-uterine inflammation or pelvic cellulitis is nearly always secondary to, or associated with endometritis and salpingitis. The symptoms, physical signs and treatment do not differ to any extent from the conditions alluded to when treating of diseased tubes and ovaries. Without looking further the physician makes a diagnosis of pelvic cellulitis when he finds a bulging of the vaginal roof, thickening, infiltration and hardening of the structures around the uterus, which may be pushed downward, forward or laterally. The rectum is impinged upon severely. The temperature is elevated, and a chill or chilly creeps are not uncommon. There is extreme tenderness in the pelvis.

PROGNOSIS. If the attack is mild it will subside with rest and treatment, but is not unlikely to leave a train of pelvic symptoms due to adhesions and impairment of structures. This is particularly true if suppuration ensues—which is quite common—and pus may be evacuated through the bladder, vagina, rectum, groin, etc. (For the treatment the student is referred to the subject of salpingitis.)

Hematoma.—This is an extravasation of blood between the layers of the broad ligament. Its cause is now generally believed to be a ruptured tube, due to ectopic gestation. Operative procedures for the removal or enucleation of growths from the broad ligament are sometimes followed by such an escape of blood. As with extravasations in other structures suppuration may ensue, the blood may be harmlessly absorbed and the tumor can no longer be recognized.

The symptoms are sharp pelvic pain, shock and the usual symptoms of blood loss. These may be but temporary, but with their occurrence a tumor appears in or above the pelvis, in the region of the broad ligament.

DIAGNOSIS. The tumor is immobile and not particularly painful to the touch, which is an important point of distinction between this and inflammatory lesions of the pelvis. These latter are not characterized by such a sudden onset and subsidence of symptoms. There are usually no febrile symptoms with hematoma. It may sometimes be attended with vesical and rectal tenesmus, depending upon the direction pursued by the effusion. If the symptoms subside and do not recur no operative treatment will be required.

Hematocele.—This term is generally applied to a collection of blood in Douglas' cul-de-sac. The causes are tubal gestation and intra-abdominal operations.

The symptoms are those of hematoma and tubal abortion or the post-operative symptoms of internal hemorrhage. The physical signs

are a soft, fluctuating or doughy mass, which may be made to shift if the pelvis is turned. The intestines are raised and the vaginal vault depressed. The mass becomes dense and smaller with encapsulation.

Neoplasms of the Broad Ligament.—These do not require separate consideration, as their symptoms and treatment are practically those of ovarian tumors.

Treatment.—The treatment of the diseases of the broad ligaments will be found under diseases of the Fallopian tubes.

SECTION XXVIII.
SURGERY OF THE BREAST.

CHAPTER I.
ANATOMICAL FEATURES.

Definition.—The mammary glands are accessories to the generative system and exist in the male as well as the female. In the former, unless excited by disease, they exist only in the rudimentary state and are very infrequently called to the attention of the surgeon. In the female these organs vary much in size and feel in different women and in different periods of life. Before puberty they are of small size, enlarge as the generative organs become developed, increase in size rapidly during pregnancy and atrophy in old age. Under normal circumstances the left breast is a little larger than the right. The glands are situated on the lateral aspects of the pectoral regions and extend from the third to the sixth or seventh rib, and from the sides of the sternum to the axillæ. The base of each gland is nearly circular in shape, being slightly concave where it rests upon the fascia covering the anterior aspect of the pectoralis major, serratus magnus and external oblique muscles. Its exact boundaries are difficult to define, as not infrequently a process of the gland extends toward the axilla, and sometimes into other portions of the surrounding adipose tissue. The outer surface is convex, being somewhat thicker at its axillary circumference than at its external. The gland proper is surrounded by a fibrous envelope which is intimately connected to the integument and superficial fascia by fibrous bands or laminæ, and these, together with the areolar tissue at its base, hold the gland in its place.

Nipple.—Just below the centre of the gland on the outer surface is a small conical prominence, the nipple or mamilla. Occasionally this is very small, being almost on a level with the skin, or it may be depressed or even absent. It is surrounded by an areola having a colored tint, which in the virgin varies in color from a rosy tint to a light brown, according to the complexion of the patient. During pregnancy it acquires a darker tinge, becoming dark brown or even black in color. The skin covering it is wrinkled and in the sulci thus formed are numerous sebaceous glands, which open into the little papillæ with which its surface is covered. The nipple consists of numerous blood vessels, terminal milk ducts, intermixed with muscular fibres, and possesses the power of erection upon direct irritation or reflexly from sexual excitement.

Structure of the Gland.—Three tissues enter into the structure

of the mammæ, the gland tissue proper, the fibrous tissue connecting its lobes, and the fatty tissue which fills in the spaces. The former is firm in feel, of a pale reddish color, and is formed of numerous lobes, connected by blood vessels and ducts. These lobes are quite independent of one another. For this reason in the treatment of mammary abscesses it may be necessary to make several openings in order to completely evacuate the pus. The excretory ducts, some fifteen or twenty in number, converge toward the areola where they become dilated so as to form little sacs, or milk reservoirs, contracting again as they enter the nipple. The vesicles and ducts are lined with glandular epithelium, which varies according to the condition of the gland. In the non-pregnant the alveoli are small and solid, being filled with a mass of glandular, polyhedral cells. During pregnancy the alveoli enlarge and the cells undergo multiplication, still further changes taking place during lactation. The fatty tissue which is found between the lobes and lobules also surrounds the gland and to a large extent determines its form and size.

Blood Vessels, Nerves and Lymphatics.—To the surgeon it is interesting to remember that the blood supply of the breast enters largely at the upper and axillary border of the gland, being derived from the thoracic branches of the axillary, the internal mammary and intercostal arteries. It is returned by veins which pursue a somewhat similar course to that of the arteries.

The nerves are derived from the anterior and lateral cutaneous nerves of the thorax. By their communications is formed a nervous connection with the axilla, arms and shoulders.

The breasts are supplied with both superficial and deep lymphatics, the former being connected with the lymphatics of the arm, and the superficial lymphatics of the neck; the latter, with the axillary lymphatics, surrounding the deeper vessels, and extending under the pectoralis major muscle, the clavicle and the deeper cervical structures. Posteriorly they lie upon the fascia of the pectoralis major and may pass through the intercostal spaces, with the artery and vein, to the lymphatics of the mediastinum and pleura. The substernal glands receive the lymphatics from the inner portions of the breast; so that a morbid growth near the inner margin is more liable to involve the substernal lymphatics than one in any other portion of the breast. It is because of this varied connection that disease may be conveyed to so many different portions of the system.

Malformations of the Breast.—Supernumerary nipples and mammæ are usually found on the anterior pectoral region in close proximity to the normal organ, but they have been found in the axilla, on the back, over the acromion process, on the thigh, and in the abdominal wall. The supernumerary nipple may be associated with a separate gland or may be close to the normally situated one and connected with the gland proper. As a rule the supernumerary mamma or nipple is not a useful organ, but merely a rudimentary appendage. Several enlargements which have been diagnosed as supernumerary mammæ have been found upon excision and examination to be circumscribed fatty tumors. In one case which came under observation the external appearance very closely simulated the normal gland. The enlargement was directly under the right breast, was about one-half the size of the natural organ, and upon its most

prominent portion was a nipple-like projection. Upon excision the protrusion proved to be a mole and the enlargement a fatty tumor.

TREATMENT. In a large share of cases the abnormal gland requires no treatment. If, however, it occupies a position where there is the risk of more than usual injury, or a position where it interferes with some other natural function, it should be removed by excision. Indeed, considering the uselessness of multiple glands and the great susceptibility of undeveloped organs to disease, it is believed that the patient is better off if the gland be excised at an early date.

Congenital Absence of Mammæ.—This is a very rare deformity. In the few cases recorded the right gland has been the one absent. Associated with the deformity there has sometimes been more or less deficiency of the muscles and bony tissues of the corresponding thoracic wall. In a curious case reported by Wylie both mammæ were absent. The patient was twenty-one years of age and had given birth to one child. No pain or inconvenience was occasioned by the absence of milk.

CHAPTER II.

REFLEX DISTURBANCES AND HYPERTROPHY OF THE MAMMÆ.

Reflex Disturbances.—Previous to puberty the breasts, surgically considered, are unimportant organs. Occasionally in the infant, along about the fourth or fifth day, they may become a little tender and swollen and secrete a small quantity of milky fluid; but a little sponging with warm water, the application of a warm poultice, or protection by means of cotton batting from the irritation of the clothing is usually sufficient to prevent trouble, and in a few days the irritation subsides. Upon the advent of puberty the glands take on a new growth and added possibilities of disease. Irregular establishment of this function is often accompanied by mammary troubles of a sympathetic nature. There may be at the menstrual period enlargement and tenderness of the breasts and axillary glands, with neuralgic pains extending down the arms, or there may be simple enlargement and tenderness of the breast without pain. These conditions often give rise to the fear that the patient has a cancer or some other form of morbid growth. The condition of the patient's general health, the presence or absence of ovarian or uterine disturbances, and the relations which these conditions bear to menstruation are the points to be considered in making a diagnosis. In general it may be said that where no tumor can be detected or where the enlargement is found only at the menstrual period the more severe the pain and the greater the sensitiveness the greater the probability that the trouble is of reflex origin.

TREATMENT. Every effort should be made to improve the general health and to relieve any local irritation which may be present. Exercise in the open air, abundance of good, nutritious food, regular and sufficient hours of rest, the avoidance of excessive fatigue, and unusual excitement may be advised for the neurasthenic. In some instances the correction of a misplaced, or reflexed or retroverted uterus may relieve the whole difficulty. Such remedies as belladonna, calcarea carbonica, cimicifuga, croton tiglium, lilium tigrinum, nux moschata, pulsatilla, sepia and sulphur may be demanded.

Hypertrophy of the Breast.—Hypertrophy of the mammæ may occur in either sex, affecting either one or both glands. It depends upon an abnormal growth of the glandular structure and usually commences soon after puberty. It has been noticed in men as a sequel to mumps, accompanying atrophy of the corresponding testicle. In women it is not so easy to say when the enlargement becomes pathological, inasmuch as there are physiological variations in the size of the mammæ. The enlargement, however, may reach a size that is easily seen to be abnormal. Chassaignac reports a case in which the breast weighed thirty pounds and hung down as low as the knee, and Durston tells of a girl whose right breast

weighed forty pounds, and left, sixty-four pounds. (Ashurst page 849, Figure 506.) Nothing definite is known as to the cause of this morbid condition. The facts, however, that some menstrual irregularity or disease of the ovaries or testicles has been found, and recognition of the close relationship between these organs make it seem probable that the increased growth is due to some general disturbance of the generative apparatus.

DIAGNOSIS. It occurs usually between the ages of fourteen and thirty, as a uniform and permanent increase in the glands entirely out of proportion to the increase in other portions of the body, and beyond that met with in the period of functional activity. The breast is at first large and firm, but subsequently becomes pendulous and almost pedunculated. No sensation of localized induration can be found, neither is the breast sensitive to the touch.

PROGNOSIS. The disease is rarely a fatal one, unless accompanied by general emaciation and frequent pulse.

TREATMENT. The treatment should be both local and general. Systematic compression of the breasts by a firm bandage not only gives comfort to the patient but may be effective in retarding the growth. Any irregularity of the menstrual function should be corrected, any irritation of the uterus or its appendages removed, and the general health placed in the best possible condition. The selection of the internal remedies should depend more upon the general symptoms than any local symptoms present. However, belladonna, phosphorus, phytolacca, robina and viburnum may be considered.

The fact that removal of the ovary often produces atrophy of the breast would indicate that this might be a serviceable form of treatment. As a last resort the breast may be amputated when the growth has reached such a size that it is no longer endurable.

CHAPTER III. INFLAMMATORY DISEASES.

Inflammation of the Nipple.—Previous to pregnancy the nipple is rarely diseased. During lactation, however, it frequently becomes the seat of fissures and excoriations. This may be due to a lack of development of the nipple, which prevents the proper emptying of the breast and thus results in retention and engorgement, to a lack of cleanliness on the part of the patient, or to a tendency on the part of the patient to eczema or other skin affections. The trouble is not limited to the nipple, but usually extends to the areola. The parts become red and swollen, suckling causes severe pain, the fissures often bleed, the skin becomes destroyed, and septic lymphangitis or mammary abscess may result.

TREATMENT. After the child nurses the part should be gently and thoroughly cleansed, and if the nipple only is sensitive it may be powdered with flour and lycopodium. If erosions are established some mild astringent, as borax, alum or tannin, may be used as a wash. Excellent results have followed the application of equal parts of glycerine and calendula tincture. If the fissures are upon the areola they may be protected by painting with oleaginous collodion or a compound tincture of benzoin. Neither of these remedies need interfere with nursing, while at the same time they protect the abraded surfaces from the irritation of the milk and the saliva of the child. If this does not suffice both areola and nipple may be protected by a proper-fitting shield. Fissures showing little tendency to heal may be stimulated by the application of a five-grain to the ounce solution of the nitrate of silver. As soon as healing begins the protective dressing may be applied. In very severe cases, in which suckling is attended with extreme suffering or in which destruction of the nipple is threatened, the mother must be advised to give up any attempt to nurse the child. Internal remedies are often of service, the condition in many cases being due to a constitutional tendency toward eczema. Such remedies as sulphur and graphites are frequently demanded, but arnica, chamomilla, pulsatilla, calcarea carbonica, silicia, hydrastis and zincum may be consulted. Abscesses of the areola are not uncommon. They are usually quite superficial and should be promptly opened as soon as detected. The incision should be preferably made in the course of the lactiferous ducts, so as to avoid dividing them, and should be made with antiseptic precautions. Hepar sulphur, silicia or sulphur is usually called for. Sir James Paget has described a chronic eczema or psoriasis of the nipple and areola which attacks women between forty and sixty years of age. The disease seems to start in the nipple, and after destroying that gradually extends to the surface of the areola, finally terminating in carcinoma. In its earlier stage the nipple is red and granular and exudes a clear yellowish fluid. In many cases the disease from the start is a superficial epithelioma, but in others its long

duration would seem to indicate that at first, at least, it was some form of eczema. If taken in time this disease, I believe, is amenable to homeopathic remedies. When the nipple is red, irritable and exudes a clear yellowish discharge graphites is indicated; when the parts tingle and burn, arsenicum or sulphur. Other remedies may be used according to the general condition. If these do not prove of service in arresting the disease the breast should be excised.

Mammitis.—Inflammation of the breast may be produced by bruises, wounds or contusions, or may result from the extension of inflammation from the nipple, or axillary glands, from the inability of the child to empty the breast, from exposure to colds, or from the infection of the system by septic matters. It is sometimes met with in infants shortly after birth, and it is not uncommon at or about puberty in boys as well as girls. Indeed, any chronic enlargement between the sixteenth and twentieth years of age is usually due to localized mammitis. A large proportion of the cases occur during lactation and undoubtedly much of it is due to the bruising of the breasts by injudicious attempts at rubbing out the milk.

SYMPTOMS. The first indication of the disease is a feeling of hardness and stiffness over the breast, followed by a chill and fever. The part becomes tense, hot and swollen and exquisitely tender. The inflammation may confine itself to one or more lobes or may involve the greater part of the gland. It may end in resolution, chronic thickening of the breast structure, or suppuration. If suppuration takes place it may be either superficial to the gland, in the gland substance, or behind the gland itself. In the first form it does not differ from an ordinary abscess. In the second form it may be limited or diffused, being confined to a single lobule, or occupying nearly the whole breast, several cavities and sinuses being present. In the third form, or the post-mammary, it may start either in the costal portion of the glands, or in the cellular tissue between the breast and chest wall. In either case it is slower in progress than the other forms and accompanied by a deeper-seated, throbbing pain. As it enlarges it pushes the gland forward, producing a peculiar conical projection. If the abscess is purely post-mammary it points at the inferior and external border of the breast. But if it starts in the costal surface of the breast it may work its way gradually through the glandular structure and point somewhere along the superficial surface.

TREATMENT. Mammitis in the new-born is usually subacute and readily responds to fomentations of lead water or the application of hot poultices. In a few cases suppuration occurs. When this takes place the abscess should be opened at once, using the usual antiseptic precautions. Inflammation of the breast at puberty is often accompanied by a slight secretion of milk. It rarely goes on to suppuration. The removal of the irritation of the clothes, correction of the accompanying menstrual difficulties, and the application of heat, as hot lead water or flax-seed poultices, with the appropriate homeopathic remedy, will in almost every case result in resolution.

Inflammation of the breast after puberty and unaccompanied by pregnancy is rare except from injury, or in depraved subjects the result of some constitutional disease. In the former instance rest, elevation of the breast, the application of cold in the early stages, or heat in the later

stages, together with the appropriate homeopathic remedy, are all that is demanded. In the latter cases constitutional treatment must be depended upon to prevent suppuration. If this takes place the surgeon must wait until the surrounding inflammation is reduced to a minimum before the abscess is laid open. If it is then thoroughly cleansed and the walls curetted prompt healing may be expected.

Puerperal mammitis is largely a preventable disease. An aseptic confinement, followed by careful treatment and attention to the presence of any abrasions of the nipple or areola, should be rarely followed by inflammation and suppuration of the breast. In saying this it is not intended to recommend the constant use of vaginal injections, but rather to advise care in examinations and use of instruments and cleanliness on the part of obstetrician, nurse and patient. In a large private obstetric practice carried on for several years rarely

has a case of suppuration of the breast been met with. When the breast becomes surcharged with milk and obstruction, with attendant irritation, and congestion seems imminent, gentle rubbing of the breast from the periphery to the nipple will usually relieve. This pressure should be made with great gentleness, both hands being used, acting on opposite sides of the breast, and well oiled to prevent superficial injury. If inflammation does occur the patient should be placed in bed on a light diet and the breast bandaged against the thorax. Nursing should be discontinued from the affected breast and every undue distension removed with the breast-pump. This latter expedient is rarely necessary, for true inflammation usually reduces the secretions of milk. By careful bandaging almost any puerperal inflammation not due to septic infection may be carried to successful resolution.

A bandage of firm muslin or flannel, made in the form shown in Fig. 848, the dimensions of which suit the average case, may be applied

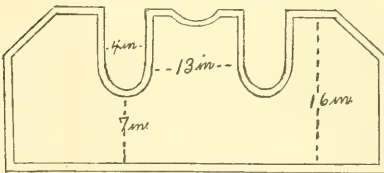


Fig. 848. Diagram of Bandage.

as follows: The breasts are brought forward on the anterior wall of the thorax and a layer of cotton placed between them. The axillæ are filled with cotton and an even layer of cotton placed over the breasts. The bandage is then applied and tightly pinned down the center and over the shoulders. It is tightened from time to time, as it relaxes.

If an abscess does form and it is retro-mammary it should be opened as soon as discovered, the opening being made preferably at the lower and outer part of the swelling. If the breast is pushed forward and the



Fig. 847. Breast Bandage Applied in Mammitis.

symptoms indicate the formation of pus behind the glands an incision may be made at the lower border of the gland, the gland lifted up and dissected away until the pus cavity is reached. If the abscess be in the gland itself measures may be delayed until the pus reaches the skin, when the cavity should be opened by a free incision made in the radius of the gland. In every case the usual antiseptic preparation should be made before incision. Long-continued suppuration is often due to the uncleanly practice of opening abscesses with no other preparation than the removal of a foul poultice. After thorough evacuation and gentle cleansing of the cavity it should be drained and dressed with an antiseptic dressing, which is all that is usually needed. If the case has been neglected and sinuses have formed these must be thoroughly curetted and treated as a fresh wound. In old cases of retro-mammary abscesses which have discharged through the gland it may be necessary to partly dissect away the gland from the chest wall, thoroughly curette the anterior sinus and the pus-chamber, and drain from the inferior border of the gland by the new opening. In all these cases thorough antiseptic treatment, with bandaging, is followed by rapid healing; whereas small incisions, with frequent pressing and irrigating of the gland, the organ being allowed to hang loosely and form a receptacle for pus, necessitate a long course of treatment and may result in the formation of multiple abscesses.

MEDICATION. There are many homeopathic remedies of great value in the treatment of these inflammations, but they cannot be prescribed on local conditions alone. The same rules that govern the selection of remedies in other diseases must here be followed. In general it may be said that mammitis at or about puberty may require belladonna, pulsatilla, calcarea carbonica, sepia or sulphur. In the period between puberty and pregnancy, as ordinarily observed, the same remedies with the addition of aurum, bryonia and baryta carbonica will apply.

During the puerperal state belladonna, bryonia, calcarea, conium, camphora, hydrastis, causticum, cimicifuga, graphites, hepar sulphur, lachesis, mercurius, phytolacca, pulsatilla, and phosphorus are more frequently called for during the inflammatory period. Cimicifuga, sepia, pulsatilla, to reduce pain, and conium, phosphorus, silicia and sulphur for the removal of long-lasting indurations will be found useful.

Chronic Mammitis.—Chronic inflammation of the breast is exceedingly rare. When it does occur it appears as a painless or slightly painful, movable induration. This gradually softens, the skin becomes red and spontaneous opening occurs. Many of these conditions are not true abscesses of the breast but are due to some inflammatory process of the tissues directly underneath the breast. In one such case coming under notice, in which a fistulous tract had existed for a long time, the abscess was found to be due to necrosis of an underlying rib.

Chronic inflammation of the gland itself may take place, resulting either in a diffuse abscess or an encysted one. The former condition is usually found in those of depraved or scrofulous diathesis and is usually retro-mammary. The latter is often due to a blow resulting in an encapsulated extravasation of blood which eventually becomes purulent, or such an abscess may come on slowly after confinement or abortion, being due to sepsis.

DIAGNOSIS. The diagnosis in these cases is often very difficult to make

and can only be definitely settled after careful observation. Great trouble is frequently experienced in differentiating between this enlargement and true tumors of the breast, and undoubtedly many unnecessary amputations have been done on this account. The history of the case as to possible injury and sudden appearance, as in the extravasation of blood, is of great value in the decision. In addition to this it may be noted that the abscess occurs more frequently in early adult life than late adult life, as in the case of neoplasms, the pain and tenderness are usually greater from the start in chronic mammitis than in carcinoma; the growth does not steadily increase as in neoplasms; the axillary glands if enlarged are not indurated, and the enlargement is more diffuse than in the benign tumor and less hard than in the scirrhus. If any doubt exists aspiration or incision of the suspected tumor must be tried to determine the character of the growth.

TREATMENT. This should be directed first to the improvement of the general health. The patient should be well fed, hygienically clothed and housed, and any uterine or ovarian irritations removed. The breast should be supported and if pus has not formed equable pressure applied. During this stage such remedies as ammonium carbonicum, aurum, calcarea carbonica, calcarea phosphorica, ferrum phosphoricum, iodum, mercurius, phytolacca, sepia and sulphur may be consulted. If suppuration has taken place the parts should be freely incised, as in the case of acute abscess, the walls curetted, cleansed and lightly packed with iodoform-gauze. The breast should then be dressed as recommended in a case of acute abscess. During this stage hepar, calcarea, sulphur, mercurius, phosphorus, hydrastis, kreosotum, nitric acid, sulphur and silicia may be consulted.

Tuberculosis of the Breast.—Primary tuberculosis of the mammæ is very rare, or at least it has not been frequently observed. Velpeau describes tubercles in the skin of the mammæ as isolated masses which contain a yellow, cheesy pus with accompanying enlargement of the axillary and cervical glands. A tumor which grows slowly, resulting in suppuration and the formation of sinuses, should excite suspicion and its discharges should be placed under the microscope. If the bacillus tuberculosis is found the diagnosis is complete. More frequently tubercular affections of the breast result from infection from the neighboring cellular tissue, lymphatic glands or bones, or in the progress of pulmonary tuberculosis. In a patient recently under observation not only were the lungs and mammæ involved, but also, as the post-mortem proved, the intestines and bladder.

TREATMENT. Tuberculosis of the integument or nodules in the integument should be treated by excision of the infected tissue. If the fistulous tract does not extend into the gland proper, incision, curettage and packing with iodoform-gauze should be practiced. If the gland itself is involved it should be removed, with any enlarged gland that may be detected at the time of operation. At the same time the patient's general health should be improved by rest, forced feeding, daily bathing, friction of the skin and by the exhibition of the appropriate homeopathic remedy, as indicated by the general symptoms of the patient. Tuberculin is highly recommended by Arnulphy in these cases.

Syphilitic Affections.—Syphilis may attack the nipples primarily

as a simple ulcer, or secondarily as broad condylomata; and syphilitic swellings in the form of uniform, indurated enlargements of the gland itself have been cited by Sauvages, Martin, Biercher, Verneuil and others; as occurring in the secondary or tertiary period. It is, however, a very infrequent affection of this organ apart from the involvement of the skin.

TREATMENT. This does not differ from the treatment of syphilis when found in other portions of the body.

CHAPTER IV.

TUMORS OF THE MAMMARY GLAND.

Classification.—Tumors of the mammary gland do not differ in their nature from similar tumors in other parts. However, the structure and peculiar physiological conditions of this gland admit of so many combinations that the classification of tumors as found in the breast has differed widely among the recognized authorities. The presence of acini and ducts in mammary growths has led many observers to believe that these glandular elements were of new formation, and has resulted in the use of such compounds as adeno-fibroma, adeno-cystoma, adeno-sarcoma and similar terms.

Instead of being newly formed the secreting elements are usually accidental and represent the remains of old or pre-existing gland tissues, contained but widely separated in a fibromatous or sarcomatous stroma, the neoplasms not only having spread in themselves but having so attacked the neighboring gland globules that a more or less considerable part of the gland is involved. There is no more important difference in the anatomical relations of the neoplasm to the infiltrated tissue of the gland than of the neoplasm to bone or muscle which it may involve; and as these instances are not spoken of as myo-fibroma or myo-sarcoma it does not seem necessary in considering the tumors of the mammary gland to add the misleading word adenoma to the description of the different growths.

The subject will, therefore, be considered under the following classification:

First, Cysts. Second, Typical connective tissue tumors; tumors resembling fully developed connective tissue, as fibrous tissue, fibroma, adipose tissue, lipoma, bony tissue, osteoma, cartilaginous tissue, chondroma. Third, Atypical connective tissue tumors; tumors resembling embryonic tissue; sarcoma, myxoma. Fourth, Higher tissue tumors, neuroma, angioma. Fifth, Typical epithelial tissue tumors, adenoma. Sixth, Atypical epithelial tissue tumors; tumors resembling epithelial tissue, carcinoma. Of these the two atypical classes are recognized as containing the malignant growths; the remainder the non-malignant or benign growths. The word cancer is commonly applied to the malignant growths, but anatomically it means carcinoma and will be so used here.

Cysts.—Cysts, except such as occur in the breaking down or degeneration of other tumors, are found under two forms. The Retention Cyst and the Hydatid Cyst, or cyst of new formation. The former includes simple cysts and lacteal cysts or galactoceles.

SIMPLE CYSTS. Simple cysts as a result of the dilatation of the acini, with occlusion of the exit, may occur at or about the menopause, when the glands are undergoing atrophy. They are usually seated at the posterior surface and rarely reach a very large size. Their rate of growth is usually slow and they are unaccompanied by pain.

More often these cysts occur during functional activity of the breasts. They are then due to dilatation of the lacteal sinuses and larger ducts. These are more common in the central area of the breast and are often situated near the areola. They are usually of slow growth and rarely reach a large size. In either case the cysts may be single or multiple. They may contain a clear colored fluid, sero-sanguinolent fluid, or fluid of a green, brown or dark red color. The diagnosis is often a matter of great difficulty, covered as they usually are by more or less gland tissue. Their firm consistency renders them very liable to be mistaken for a small solid growth. Their clinical features are their slow growth, painlessness, mobility, firm, rounded feel and absence of all glandular involvements. If doubt exists the exploring needle may be used.

GALACTOCELES.—These cysts contain either pure or altered milk. A sinus or duct becomes closed and is gradually dilated by milk as fast as it is secreted. The cysts are almost invariably solitary and begin, as a rule, beneath the areola. They are not accompanied by inflammation or pain. They appear during the early months of lactation, and at first grow rapidly; when, however, lactation ceases they diminish in bulk, a part of the fluid contents being absorbed. The general outline is oval and smooth, but it may become lobulated as a result of a rupture of the wall at some point, and the encapsulating of the contents by connective tissue.

Diagnosis. A large solitary, pendulous, painless, soft and fluctuating tumor which forms suddenly during lactation is in all probability a lacteal cyst. The diagnosis offers some difficulties when from long retention the cyst contents may become more or less solid. It may then resemble a fibroma. The fact, however, that the tumor developed a few weeks after parturition and was at first soft and fluctuating should settle the diagnosis.

HYDATID CYSTS. Hydatid cysts of the breasts are extremely rare. An embryo of the tenia echinococcus finds its way into the stroma of the mamma, is transformed into a vesicular worm, becomes encapsulated by a fibrinous membrane of new formation, grows and multiplies, and a tumor is formed. In some instances there is a single cyst, with scolices adhering to its inner wall or germinal membrane. In others there is a parent cyst, containing smaller vesicles, varying in size from a bean to a hen's egg.

Diagnosis. These cysts are liable to be confounded with retention cysts, and it may be impossible to differentiate between them previous to removal. Clinical features are, they grow slowly, attain but a moderate size, are painless, round and smooth in outline, firm and elastic in feel, are movable under the skin, are not accompanied by lymphatic enlargement, do not impair the general health, and upon incision are found to be filled with small vesicles.

TREATMENT OF CYSTS. Retention cysts may be treated by aspiration and the injection of iodine tincture or by free incision and packing with iodoform-gauze. Hydatids demand incision, curettement and packing. But all cysts are preferably treated by excision or enucleation of the cyst, all other methods being more painful and often inefficient.

Lipomata.—Fatty tumors are very rare in the female breast; the only one the author ever saw was in the left breast of a young unmarried woman. It developed behind the lower border of the gland.

pushing the breast slightly upward and forward. On account of the age of the patient, the painless character of the growth and the doubt in regard to the diagnosis, it was decided to make an incision along the lower border of the breast and examine the enlargement before attempting removal. An encapsulated fatty tumor was found, which was removed and the breast replaced and sutured. The tumor was about the size of a hen's egg. Isolated cases have been reported by other observers, but in no instance has the tumor been found in the glandular structure, or even in the connective tissue binding the lobules together. Billroth reports one case in which the tumor had a measurement of seventeen and one-half inches from its upper border to the nipple, and Velpeau one weighing four and one-half pounds, which reached, when the patient stood up, downward to the crest of the ilium. The diagnosis is difficult because of the usual location of the growth behind the breast, which makes it almost impossible to determine its character.

TREATMENT. If the tumor is recognized before it has reached so large a size as by its pressure to have destroyed the glandular structure, the breast may be dissected away from the chest, as in the case cited, and the tumor enucleated without interfering with the glandular structure. If the tumor has reached a large size and the gland been destroyed by pressure the whole mass should be excised.

Cartilaginous Tumors.—**CHONDROMATA.** No thoroughly authenticated case of pure chondroma of the breast has been recorded, although various of the earlier authorities have mentioned such cases. Chondroma-like masses have been found in certain cysts and certain sarcomas, but even this condition is very rare.

Fibrous Tumors.—**FIBROMATA.** Fibrous tumors are more frequently found in the mammary gland than any other form of the typical connective tissue series. They are found in the connective tissues of the substance of the gland and are often multiple. In one patient coming under the author's care there were eight found in one breast and five in the other. They were hard, firm and painless and varied in size from a hazel-nut to a walnut. The patient was forty years of age and some of the tumors had been present for more than ten years. In general it may be said they are found between the sixteenth and fortieth years, rarely later. They are of slow growth unless sarcomatous degeneration takes place, and rarely reach a large size. Inflammation or suppuration is very rare. The only danger of



Fig. 849.

Microscopic Section—Thirty Diameters—Halphide.

their presence consists in the possibility of sarcomatous or carcinomatous

degeneration. Upon removal these neoplasms are found to be completely encapsuled and section reveals a white, hard, opaque or pale yellowish substance which grates under the knife. (Fig. 849.)

DIAGNOSIS. A tumor which is uniformly hard, nodular and movable, which grows slowly, is free from ulceration, is not accompanied by any change in the skin, veins or nipple and in which the lymphatic glands are not involved, particularly if it is found in a young woman, is probably a fibroma. If a number of these tumors are found in the same breast the diagnosis may be made all the more positively. If such a tumor has existed for many years and then suddenly grows rapidly and presents points of fluctuation, but is not accompanied by lymphatic involvement, the probabilities are that this growth has taken on cystic degeneration.

PROGNOSIS. These tumors do not recur upon removal.

TREATMENT. If many of these tumors exist and show no signs of growth they may be allowed to remain if their presence causes no inconvenience. They should be kept under supervision, however, and removed promptly if enlargement takes place. A single tumor should be excised; such operation does not destroy the contour of the breast and the difficulty of making a correct diagnosis in such cases might result in the leaving of a malignant tumor.

CHAPTER V.

ATYPICAL CONNECTIVE TISSUE TUMORS.

Sarcomata.—Sarcomata appear in the breast in all of the forms; round cell, spindle cell, giant cell, as well as in the myeloid or mixed form, in which both round and giant cells are found. These tumors have their origin in the endothelial cells of the connective tissue stroma of the mamæ, and as a result of irritation proliferate and form masses of imperfect cells, which together with the white blood corpuscles and fat cells form the basis of the neoplasm. Into this new mass blood vessels make their appearance as they do in normal granulation tissues. Of the different varieties the spindle cell is most frequently found.

In general they are rounded or irregularly spherical, the irregularities being more marked where cystic degeneration has taken place than in the original growth. On section the spindle cell tumors (Fig. 850) are usually smooth, of a white or grayish-white color, and creak under the knife. The round cells, on account of their greater vascularity, are either red or reddish white and somewhat resemble brain tissue. As

they grow they press aside the gland tissue, become attached to the integument and eventually ulcerate. This process does not occur as early as in carcinoma, and seems to be due to inflammation and necrosis of the skin rather than to its infiltration by sarcomatous cells. If allowed to go for any length of time the tumor may undergo myxomatous, cystic, calcareous, telangiectatic, or even fatty, metamorphosis. Indeed, almost any form of connective tissue may be found. Billroth mentions a case in which plates of bone were found in a large cystic sarcoma.

Cystic degeneration is the change that most frequently occurs, and to this are due the sudden changes of shape which are a marked feature of growth in the more malignant forms. The cysts thus formed may contain a mucoid substance, a fatty fluid, or even large quantities of blood. In some instances this fluid may discharge in small quantities through the nipple. The tumor usually occurs singly, either beneath the nipple or the upper and inner border of the gland, and gradually extends until the entire gland is involved.

The rate of growth varies much, depending somewhat upon the age of the subject and the character of the cells. Thus, while in one case it

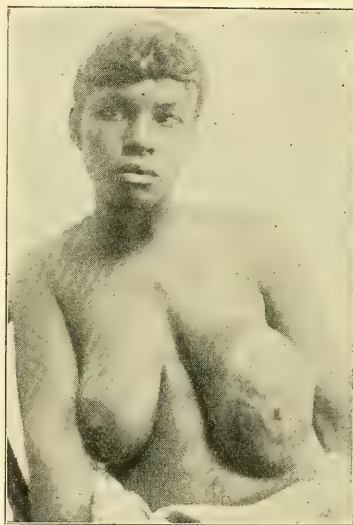


Fig. 850. Spindle-Cellled Sarcoma—Macdonald.

may require but six months for a tumor to reach the size of one's fist in another it may require three years.

As a rule it may be said that the spindle cell variety is of slow growth, and the round cell of rapid growth. Cessation of growth may even occur for a time. It is not unusual after a period of quiescence for the tumor to take on a very rapid growth with evidence of cystic degeneration. A rapidly growing tumor may be accompanied with a marked elevation of temperature in the affected part. In one of the author's cases the increase of temperature, the redness of the integument, localized softening, and the fact that it occurred in the breast of a woman who had nursed her child but a few months previously, led the attending physician to lance it, believing it to be an abscess.

Sarcoma may occur in the breast at any period of life, but is most frequent between the ages of thirty and forty, appearing very infrequently after the menopause.

There is usually very little pain during the early history of the growth. When ulceration takes place there is some increase in the discomfort, but the sharp pains of carcinoma are usually absent. Involvement of the axillary lymphatics does not take place until late in the progress of the growth, and when present is due to irritation rather than to specific infection of the glands. General infection, it is believed, takes place through the vascular channels, rather than through the lymphatics, and thus while the axillary glands may be unaffected secondary tumors may be forming in the lungs or other parts, the sarcomatous elements being carried directly to them. For this reason no operation should be made upon a sarcomatous breast until the condition of the lungs has been satisfactorily determined.



Fig. 851.

Ulcerating Sarcoma of the Breast—Macdonald.

DIAGNOSIS. A small, slowly growing fibrous sarcoma may in its early history be difficult to distinguish from a fibroma. A rapidly growing sarcoma, attended by elevation of the temperature and cystic degeneration, especially when occurring during the period of functional activity of the gland, may be easily mistaken for a mammary abscess.

A tumor which is hard and lobulated, which grows at first slowly and afterwards with great rapidity, or which grows rapidly from the start, which makes its appearance between the sixteenth and the fortieth years of age and has little pain, is not accompanied by lymphatic involvement, which does not ulcerate early but which may be accompanied with dilatation of the superficial veins and inflammation of the integument is probably a sarcoma. If it is of irregular consistency it is probably a cystic sarcoma. If the growth is uniformly rapid it is probably a round cell sarcoma. If the tumor occurs in a young girl before puberty and the growth is uniformly slow it is probably a spindle cell sarcoma. It may be distinguished from carcinoma by the fact that it occurs at an earlier age, is of more irregular growth, does not so readily contract adhesions.

is not attended by retraction of the nipple, or early axillary involvement, and by the fact that ulceration does not take place until late in the progress of the disease, and when it does occur is attended by fungous protrusion rather than by the presence of a deep, excavated ulcer.

PROGNOSIS. The prognosis of mammary sarcoma will vary more or less according to the constituents of the growth, the age of the patient, and the rate of growth of the tumor. The round-celled sarcoma, whether cystic or solid, is excessively malignant, the disease, if not interfered with, sometimes destroying the patient in six or seven months. The prognosis of the spindle-celled sarcoma is somewhat more favorable, but, nevertheless, the prognosis should be grave. The rapid growth of a sarcoma is an unfavorable symptom and indicates a malignant tendency, while slow growth, especially if the tumor be found in a young person, indicates more benign tendencies. The disease, at a very early date in its history, becomes disseminated, progress being made along the adventitia of the blood vessels external to the capsule. Local recurrence and visceral complication are the rule, although there seems ground for the belief that when earlier and more complete operations are made for the removal of the disease this tendency will be materially lessened.

TREATMENT. Early, free, and complete removal, not only of the tumor but the entire area of infection, is the only treatment which at present offers prospect of cure. If the tumor returns after extirpation the recurrent growth should be promptly excised. By this means a cure may eventually result, or life may be prolonged for many years. Thus, in one case coming under the author's care eight operations were made in seven years, the patient eventually dying from mitral insufficiency, no evidence of sarcomatous disease being present. Gross reports a case in which he made twenty-two operations in four years, cutting away at various times the pectoral and external and internal intercostal muscles so that pleural hernia resulted. Nevertheless the patient was in perfect health ten years and nine months after the last operation. Even if visceral complications be present it is sometimes advisable to remove a tumor in order to free the patient from the inconvenience and pain of the ulcerated mass, although no possibility of permanent cure exists.

Within the last few years inoperable sarcomas, or recurrent sarcomas, have been treated with injections of the toxine of erysipelas and the bacillus prodigiosus with sufficient success to warrant further trial. Coley gives a record of thirty-eight cases of inoperable sarcomas thus treated, with nine successes. None of these tumors were, however, sarcomas of the breast.

Rumbold reports one case of round-celled sarcoma of the breast in which eight operations had been made, which was successfully treated by the same method. The agent is a powerful one and not yet thoroughly understood, but the success so far obtained warrants its trial in careful hands in those inoperable cases in which all other methods of treatment seem hopeless.

Myxomata.—A true myxoma is a very rare neoplasm in the mammary gland. It is questionable whether some of the cases reported as myxomas were not fibromas or sarcomas which had taken on myxomatous degeneration.

In structure this tumor consists of a meshwork of vessels which are

filled with a mucous substance of a clear, sticky, viscid character, similar to a solution of gum arabic. It originates in the interlobular and inter-tubular tissue, and in its growth the entire mamma may be converted into a bulky mass. The tumor is usually solitary, rounded or lobulated, and is found most frequently in the upper hemisphere of the breast. It occurs between the fortieth and sixtieth years of age.

DIAGNOSIS. The diagnosis is somewhat obscure. Its doughy and rather inelastic feel would lead to its being mistaken for a fatty growth were it not that fatty growths are so rare in the substance of the gland. The fact that in some instances it becomes adherent to the integument and discolored leads to its being mistaken for sarcoma, which it resembles. A tumor that is solitary, slightly painful, doughy in feel, grows rapidly, has a tendency to contract adhesions to the integument, when ulceration takes place discharges a gelatinous material, and is unattended by enlargement of the axillary glands, has the clinical features of a myxoma.

PROGNOSIS. The tumor is of limited malignancy, showing a tendency to recur after removal, but is not accompanied by visceral complications.

TREATMENT. Thorough and complete removal of all infected tissue offers a good prospect of a permanent cure. Recurrence only takes place in those cases in which portions of the gland have been left after the operation.

Higher Tissue Tumors.—Tumors of this class, including the neuroma, myoma, angioma and lymphangioma, are not found in the breast itself, although they may be found in the integument and sub-integumental fat. Under these circumstances they need no further consideration than that given to similar tumors of the integument in other portions of the body.

CHAPTER VI.

EPITHELIAL TISSUE TUMORS.

Typical Adenomata.—This tumor, which was once believed to be frequently met with, is now believed to be exceedingly rare, it being found only twice out of six hundred and forty-nine tumors of the breast as reported by Billroth, Langenbeck, Keuster and S. W. Gross. It is a tumor formed of true glandular tissue developed within the gland, and is not to be confounded with general hypertrophy, which is an excessive uniform growth of gland structure, the only abnormal feature being the excessive size to which it attains. Its physiological type is found in the mammary tissue of a pregnant woman, but it differs from the growth during pregnancy in that during this period there is a growth of acini and excretory ducts, while in the adenoma there is an excessive production of glandular tissue without attempting to unite the acini into distinct lobules attached to excretory ducts. Upon section the tumor presents a white color and is often the seat of small cavities. These cavities or cysts, as they may be termed, are filled with a semi-solid substance, the result of the secretion and maceration of the epithelium lining the acini.

Multiple adenomas of the breast have never been reported, the tumor always being solitary and generally found at the upper and inner circumference of the mamma. It is most common during the functional activity of the breast, no case being recorded before the sixteenth or after the sixtieth year of age. It grows slowly and is not accompanied by pain, retraction of the nipple or involvement of the axillary glands.

DIAGNOSIS. It is very difficult clinically to distinguish between adenoma and fibroma. The former's clinical features are slow growth, increased by the addition of small nodules, painlessness, the absence of retraction of the nipple and involvement of the axillary glands, and the fact that it is usually found in married women and during the functional activity of the glands. A noticeable feature is the extreme frequency in which cysts occur in its substance, and this, in connection with the symptoms given above, may enable the surgeon to make a correct diagnosis.

PROGNOSIS. The tumor is a benign one and prompt removal is followed by a cure.

TREATMENT. The entire gland should be removed, inasmuch as when portions of the gland remain there is a tendency toward local reproduction.

Atypical Epithelial Tumors.—**CARCINOMATA.**—**CANCERS.** Cancer of the breast, on account of its recognized fatality, the suffering which it causes and the frequency with which it occurs must be considered the most important disease to which the mammary gland is liable. Fully eighty per cent. of all tumors of the breast are carcinomatous. Histologically it is an atypical epithelial growth, consisting of a fibrous stroma or frame work, the meshes or alveoli of which are occupied by nests of loosely heaped polymorphous epithelial cells, which, instead of being cemented together

Fig. 1.



Fig. 1. Encéphaloid Carcinoma Shears

Fig. 2.



Fig. 2. Melanosis of Hip, Kemonose.

by intercellular substance, are suspended in a serous fluid. The tumor commences by an aggregation of cells in the acini, which enlarge. Coincident with this enlargement there is an infiltration of cells into the tissue surrounding. As the cells enlarge and multiply acini increase in size, the connective tissue becomes infiltrated and nodulated masses are formed. There is nothing specific about these cells, except that they have an activity in excess of their developmental powers, and instead of producing a few mature cells produce a large number of immature cells which infiltrate the surrounding tissue and finally destroy it.

ETIOLOGY.—The causes which are operative in the production of carcinoma of the breast as in carcinoma in other regions have never been satisfactorily determined. That heredity is an important factor in many cases there can be no doubt; this inheritance must not be considered as an actual transmission of disease, but as a predisposition to a local disease, as is seen in the heredity of lipomata, chondromata and cysts. The exciting cause being present, the tumor is produced more easily in those predisposed and less so in those who have not this inherited tendency. Clinical observation seems to indicate that local irritations may furnish this exciting cause; the irritation of old scars, chronic ulcers, eczema, and psoriasis of the nipple, the pressure of corsets and the destruction of excretory ducts by suppurative mastitis may cause derangement of the local nutritive cells, so that instead of producing normal tissue only imperfect or atypical tissue results. These irritations, in conjunction with the degenerative changes which take place in the mammae at the menopause, consequent upon the cessation of the menstrual function, are undoubtedly powerful influences in the development of carcinoma. An interesting illustration of the possible potency of injury in the production of cancer of the breast is shown in the following case: A woman forty-eight years of age while attempting to board a crowded street car was struck sharply in the right breast by the elbow of a man who preceded her, causing a sharp pain in the breast. The organ remained tender for several weeks, when she noticed an enlargement. In two months this had become so pronounced and painful that her physician lanced it, believing she had an abscess. As the breast still continued to enlarge the entire gland was removed. Examination showed it to be a carcinoma. Out of ninety-seven cases coming under the author's care but twenty-seven gave a history of local injury; still, that an organ so prominent as the breast should often be injured is evident.

CHARACTERISTICS. *Age.* The common period for the development of mammary carcinoma is at or about the time of cessation of menstruation, the largest number of patients coming under observation being between the forty-eighth and forty-ninth years of age. Cancer of the breast never develops before puberty, the cases so recorded under the name of cancer being really sarcomata. It is very rare before thirty, and comparatively rare between thirty and forty years of age. The disease may therefore be looked upon as one accompanying the decline of the functional activity of the gland.

Location, Growth and Pain. Carcinoma begins in one breast. If found in the other the indications are that the disease is not primary but secondary. It starts in the substance of the gland, preferably in the upper and outer quadrant, somewhat nearer the nipple than the periphery. Its growth is rapid and uniform, but it does not as a rule reach a large

size. In scirrhus or colloid the tumor is usually smaller than the gland that it has replaced. In the medullary form the tumor is larger but rarely reaches the size of a child's head. The rate of growth depends somewhat upon the condition of the patient. During pregnancy or lactation its growth is wonderfully rapid and its tendencies pronouncedly malignant. An interesting illustration of this was shown in a young married woman, thirty-seven years of age, who had had a small tumor removed from the breast. One year later she became pregnant and soon after she noticed a nodule on the breast. Six months after the disease was advancing with wonderful rapidity. The breasts affected the axillary glands, the infra-clavicular glands, the cervical glands; indeed, all the tissues in that region were welded together in one large mass. The integument was discolored, the vessels in it large, and the pain accompanying excruciating. Under no conditions other than pregnancy could a tumor be expected to grow with such rapidity.



Fig. 852. Carcinoma of Mamma—
Author's Case.

The same tendency to rapidity of growth is shown when it attacks robust and well-nourished people, whereas in the old and lean progress is slower and the invasion of the general system delayed. The manner of growth differs from that of the ordinary benign tumors in that it does not push the glandular structures aside but invades or infiltrates them, so that in time they become a part of the cancerous mass.

The distances at which this cancerous infiltration exists from the mass itself cannot be determined by touch, but the microscope has shown that it exists some distance from the boundary of the tumor. A noticeable peculiarity is the cicatrizing tendency of the growth, as is shown by the dimpling or pitting of the skin and the burying or retraction of the nipple, both conditions being due to the shortening of the fibrous band of the mammary fascia and of the milk ducts. (Fig. 852). Retraction of the nipple, while an almost constant symptom in scirrhus, is not present in some of the other forms of carcinoma, particularly when the entire gland is not involved or when the disease is situated some distance from the nipple. The same infiltration and contracting tendency of the tumors soon result also in adhesion of the neoplasm to the chest wall, the pectoralis major becoming a part of the tumor. To the same contracting tendency is due the pain which is commonly present, the nerve filaments being pressed or squeezed by the cicatrizing of the growth. The pain differs very much in different persons and different forms of growth. More than eighty per cent. have a history of pain. In some it is one of the earliest symptoms

present, in others it does not appear until the stage of inflammation and ulceration. In some it is sharp, cutting, lancinating, extending into the shoulder, back, and arms, preventing nutrition and making life a burden, while in others it is merely a sensation of weight or discomfort. The pain or painlessness of the growth depends largely upon its location and its tendency toward cicatrization. Large, rapidly growing tumors are usually painless. Deep-seated, contracting tumors, especially those that blend together different forms of tissue, are painful.

CHAPTER VII.

OTHER INVOLVEMENTS.

Inflammation and Ulceration.—Coincident with the infiltration of the chest wall—sometimes preceding it—there is infiltration of the integument, resulting in inflammation and ulceration. This process is shown successively by the adhesion of the integument, its hardening, thickening, its tenseness and discoloration and eventually by the formation of a fissure or crack which soon widens into a more pronounced ulcer, with indurated edges, and a pale, granulating base, which discharges a thin, ill-smelling fluid. Sometimes the ulceration commences first in the substance of the gland. In such cases upon destruction a deep cavity appears with irregular edges and a base of hard granulations of dull grayish color, covered with a puriform, bloody, foul or ichorous fluid. In either case the ulceration does not destroy the tumor, which only grows more rapidly. No precise time can be given for this ulceration, but in the author's cases the average has been about eighteen months.

Lymphatic Involvements.—Infection of neighboring lymphatics is only a question of time. Commonly the first glands involved are the axillary, between which and the mammary gland there are very intimate connections through a deep chain of lymphatics, extending along the border of the pectoralis major. More rarely infection takes place along the line of the posterior lymphatics through the intercostal spaces to the glands of the pleura and lungs. The glands involved do not enlarge through sympathy or irritation, but are absolutely infected, being really a part of the parent disease, with the same tendency to infiltrate, weld together, contract and destroy tissue. From them, as new foci, the infra-scapula, infra-clavicular and cervical glands may be reached, and from them also, through the thoracic and lymphatic ducts, the cancerous material may be transported to the bones and other tissues, producing what are known as metastatic deposits. Sometimes these secondary deposits invade almost every viscera of the body and in some cases reach a size larger than that of the parent growth. Thus in a case of scirrhus of the breast coming under the author's care a secondary deposit which formed in the omentum was many times the size of the parent growth. At just what time in the progress of the primary growth the glands become involved is a question very difficult to answer. The enlargement is usually recognized at or about the time the skin becomes adherent to the mammary tumor, but the transmission of disease must have taken place sometime before.

Cachexia.—As a result of the pain, the mental distress, the discharge, the hemorrhage, the interference with important viscera by metastatic deposits, there is established what is known as the cancerous cachexia, a condition similar to that found in phthisis and other wasting diseases.

Symptoms.—The physical features given above are common to all cancers, but the symptoms presented vary somewhat according to the

relative proportion of fibrous and epithelial elements with which a given carcinoma is endowed, and for the convenience of description and study the three forms of cancer commonly recognized will be considered: The

fibrous, hard or scirrhus cancer, the soft, cerebriform or encephaloid cancer and the epithelioma.

Scirrhus.—Scirrhus of the breast commences as a partial induration or hard nodule in the substance of the gland, and is never distinctly movable within the glandular tissue. (Fig. 853). The patient may discover it by accident after it has reached the size of a walnut, or she may become aware of the commencing disease by paroxysmal pains. In many cases the lack of pain and tenderness leads both patient and physician to look upon it as an unimportant matter. A year or more may have elapsed before it has reached the size of a



Fig. 853. Scirrhus Carcinoma—
Macdonald.

small egg. The pain, as a rule, now becomes more regular. It is described as of a lancinating, burning, stinging, throbbing character. The breast, however, is not sensitive to the touch, neither at first is the integument changed. As the disease progresses the skin becomes dimpled and often retracted. If near the nipple the lacteal ducts become involved and the nipple becomes shorter and shorter, until finally it sinks below the surface of the surrounding tissue. While these changes are going on in the anterior portion of the breast the disease progresses posteriorly as well, and the tumor becomes immovably fixed to the chest wall. Nodular masses now appear in the axilla and sometimes in the supra- and infra-clavicular regions. All the time the patient's health may be uniformly good, but as the nodules increase in the axilla and neck neuralgic pain extends down the arm, and often the arm and forearm become swollen, resulting in the condition recognized as lymphatic edema. About this time, sometimes earlier in the progress of the disease, depending largely upon the depth of the tumor, the involved integument changes its normal color to a reddish hue, and a little crack or fissure is noticed in the most contracted portions of the integument. This ulcer gradually widens, the edges become bold or everted and the base is covered with gangrenous tissue, from which is poured a thin, ichorous fluid of a most pungent, disagreeable odor. With the advent of ulceration all the symptoms increase. The patient is disturbed with severe pain, digestion becomes impaired, emaciation results, the skin assumes a leaden hue and the general appearance is that of patient suffering. (Cancerous cachexia.) Some deviation from the symptoms above may take place; thus during ulceration severe hemorrhages may take place, but these are not very common. In other cases there is a discharge of a reddish color from the nipple, and in one instance which came under notice this discharge was the first indication that the patient had of a

nodule in the breast. In thin elderly women the tumor instead of enlarging the breast may contract it to a very small size, and the ulceration instead of taking the form of a round open ulcer may be only a deep fissure into the substance of the growth.

Encephaloma, or Soft Cancer.—This usually commences as a rounded, nodular tumor, semi-elastic in feel, and devoid of pain. It grows with great rapidity, enlarging the gland, and often attains a large size within a few months from its first appearance. As the tumor approaches the integument the superficial blood vessels become enlarged, giving to the tumor a somewhat mottled appearance. Soon the skin adheres, becomes reddened and glazed and evidences of fluctuation present at different portions of the growth. As the disease advances the integument gives away by ulceration and a deep abscess-like cavity is exposed. From the friable granulation tissue with which this cavity is lined profuse hemorrhages may occur. Notwithstanding the rapid growth and inflamed appearance of the tissue pain is not an early symptom, but the involvement of the lymphatics, visceral metastases and the many symptoms which go to make up the cancerous cachexia are not delayed.

Epithelioma.—This is a superficial form of cancer of the breast which starts in a fissure of the nipple, follows chronic eczematous ulceration, or appears in some wart-like excrescence which has been made sensitive by the child's nursing. The irritated surface thus formed is soon covered with a yellowish or brownish scurf, which upon being removed shows a raw surface. Although the scab may form again and again cicatrization does not take place. A thin, offensive discharge appears under the crust and the scab drops off. Granulations spring up, but they are feeble and soon die. The edges and base of the ulcer become indurated and the glandular tissues involved. From this time on the disease has all the characteristics of scirrhus, although its course is somewhat longer.

Colloma and Melanoma.—These two forms of cancer are very rare in the breast. The former is noticeable only for the gelatinous or colloid substance which it may contain, the latter by an extra infiltration of cells with granules of melanin or hematoidin. The symptoms do not differ from the forms above noticed and the growths are not otherwise distinguished from encephaloma.

Prognosis.—The prognosis of cancer of the breast is always grave, no case of spontaneous cure ever having been recorded. Without operation the duration of life with the scirrhus cancer is from one to four years, the average time being about two and one-half years—in the medullary cancer from six months to three years, the average duration being about twelve months. By an early and thorough removal of the growth life may not only be prolonged but a permanent cure may result.

Diagnosis.—It should be remembered in making a diagnosis that fully eighty-five per cent. of all tumors of the breast are carcinomatous, and of the remaining fifteen per cent. which cover the non-carcinomatous tumors fully seventy per cent. develop before the fortieth year of age. When, then, a tumor of firm consistency develops in the breast of a woman of forty years or over and continues to grow it is probably a carcinoma. If in addition to this there be a hereditary predisposition, if there be a sharp pain in the tumor, if the tumor itself



Mammmary Carcinoma with Lymphatic Edema.—Shears.

PLATE LI.

be irregular and knotty in outline, if it be firmly fixed in the substance of the gland, if it be accompanied by infiltration of the integument, retraction of the nipple, enlargement and induration of the lymphatic glands, or adhesion to the chest wall, and if later ulceration occur with the edges of the ulcer thickened, indurated and everted, the diagnosis is absolute.

The fact that upon the appearance of the tumor the patient seems entirely healthy, or that even after the tumor has reached a large size the general health is good, has little or no significance. If the tumor is first noticed at or after the fortieth year of age, is densely hard, irregular or nodulated, grows slowly and does not enlarge the gland, it is probably a scirrhus. If, later on, the skin becomes infiltrated, the nipple retracted, the neighboring glands enlarged, and the tumor the seat of an irregular ulceration, the diagnosis is positive. A soft, lobulated, solitary tumor, which grows rapidly, occurring after the fortieth year of age and having the other symptoms which have been given as common to the carcinoma, is probably an encephaloma or medullary cancer.

Clinically the resemblance between the soft carcinoma and the round-celled sarcoma is so close that it is often difficult to make a diagnosis. The fact that the latter is encapsulated and therefore a distinctly circumscribed growth, while the former is an infiltrating, non-circumscribed growth, the fact that the latter occurs before the fortieth year of age and the former after, and the fact that the lymphatic glands are involved at a much earlier date in the carcinoma than the sarcoma may be sufficient to determine the question. Practically it is a question of little moment before operation, as both need the same treatment.

Colloid carcinoma cannot be accurately diagnosed previous to removal.

Treatment.—No treatment, general or local, except the entire removal of all infected tissue, has yet been discovered for the cure of cancer of the breast. Many remedies have been heralded as curative in this disorder, but time has demonstrated the futility of all of them. Certain homeopathic remedies, it is believed, are potent in retarding the growth of the neoplasms or of service in counteracting the predisposition toward disease, but none of them have been able to permanently arrest its progress when the disease has once started, or to prevent its return if points of infection be left after an operation. The only question then that should arise in the mind of the surgeon when he has made the diagnosis of cancer of the breast is, can this disease be entirely removed? The decision of this question demands that a thorough examination be made, not only of the breast and its contiguous glands, but also of the liver, heart, lungs and other viscera, because the presence of disease in these organs makes its entire removal impossible. If the disease has involved a large area of tissue about the breast, and the supra-clavicular and cervical glands are involved, or if glands upon the opposite side of the body are affected, even if no involvement of the internal organs can be detected, the hope of complete removal cannot be entertained. A radical operation is contra-indicated in all these cases, and palliative measures should be employed. If these conditions are not present there is a prospect that the entire infected tissue may be removed, and the sooner the operation is made the better. No one is able to tell at what time infection is carried from the original tumor to the neighboring lymphatics;

and delay, no matter how small the tumor, may jeopardize the possibility of a cure, beside making necessary the removal of larger areas of tissue and the production of greater deformity. If all infected tissues can be removed a good prospect of permanent cure may be entertained. Experience has proven that when three years have passed and there is no return of the disease the probabilities of recurrence are so small that the case may be pronounced radically cured. Upon this basis Bergman reports 30 per cent. as cured, König 22.5 per cent., Kuster 21 per cent. In the author's cases great difficulty has been experienced in obtaining the subsequent history of cases operated upon, but so far as obtainable 28 per cent. of cures are recorded, and even this percentage might have been materially increased had the earlier operations been as thoroughly made as were the later ones.

PALLIATIVE TREATMENT. The general health of the patient should be carefully regulated, all digestive disturbances and menstrual disturbances being promptly met by suitable remedies. The clothing should be made loose and easy, the breast be supported and the arm, if swollen and edematous, be bandaged and carried in a sling. If the tumor be red and hot, lotions of calendula tincture, hamamelis extract, acetate of lead in the proportion of fifteen grains to the ounce, of belladonna tincture and hypericum tincture may be employed. After the surface has become broken an unirritating, antiseptic dressing may be found in the tar plaster. It not only absorbs the discharge but deodorizes it as well. Iodoform cerate, in the proportion of one part of iodoform, five parts balsam of Peru and fourteen parts of vaseline, is a cleanly and unirritating application. Another cerate compound of chloral five grains, vaseline or balsam of Peru one ounce, will often relieve pain, or use may be made of Esmarch's powder. Its composition is arsenious acid and muriate of morphia 0.25 each, powdered gum arabic 12.0; half a teaspoonful of this may be daily sprinkled over the surface of the ulcer until a yellow crust forms, which, after separation, leaves a healthy granulating surface. It has been even claimed by some observers that a continuance in the use of this powder will effect a cure. While it is believed arsenic in this form or in the second potency may be curative in epitheliomas where only the integument is involved, and great faith exists in the potency administered internally to prevent the recurrence of carcinoma after complete removal of the breast, it is doubtful if it is of more than temporary service in glandular affections where no operation has been made.

When bleeding takes place from an ulcerated or sloughing surface a piece of lint saturated in a solution of alum or tannin, or in the tincture of the muriate of iron, or in a mixture of equal parts of perchloride of iron and glycerine, and applied to the bleeding part is of service. The use of opium or its alkaloids should be withheld as long as possible, but in the last stages of the disease there is no reason why the life of the patient should not be made comfortable by its administration.

The toxins of erysipelas which have seemed to be of service in the treatment of inoperable cases of sarcoma have had little or no effect in cases of carcinoma, especially those of the breast. In certain cases an operation may be advised for palliative purposes; thus while there may be no hope of a cure, the weight, the pressure and the local pain may be removed and an open, healthy, granulating surface take the place of a

foul, offensive ulcer. In cases of lymphatic edema of the arm, accompanied by great weight and pain, amputation of the arm at the shoulder joint may be employed with great relief to the patient.

OPERATIVE OR CURATIVE TREATMENT. Operative treatment, with the exception noted above, where the knife is used for the mere purpose of relieving the patient from pain or from a foul discharge, contemplates the entire removal of all diseased tissue. It was once believed that this object was obtained when the tumor, with a certain area of apparently normal tissue, was removed, together with such enlargements as could be felt in the axilla. Experience has proven that such operations are ineffective and incomplete. The very large per cent. of local recurrence, that is recurrence in the field of operation, is an indication that all diseased tissue had not been removed.

At a very early date in the growth of the primary tumor the axillary glands take on disease. Many a cancer of the breast has been removed in which the primary tumor was very small and in which no enlargements could be felt in the axilla previous to operation, and yet in every instance on opening the axilla, the axillary glands were found to be infected. Again, both Volkmann and Heidenheim have shown that the pectoral fascia was carcinomatous even in cases in which a thick layer of apparently healthy fat separated the carcinoma from the pectoral muscle. For a time this fascia serves as a sort of barrier, the cancerous tissue spreading itself out in flat islands on the fat tissues, but only for a time. Soon it penetrates this and involves the pectoralis major muscle. A complete operation then should contemplate the removal of infected integument, the entire mammary gland with the fascia of the pectoralis major muscle, and even the muscle itself when the disease has made considerable progress, together with the axillary and infra-clavicular glands and fat.

Should recurrence take place the nodule should be promptly excised. Life may thus be prolonged and the patient remain in comfort for years, even if cure does not result.

OPERATION. The patient is prepared on the day previous to operation by shaving the axillary region, thoroughly scrubbing the shoulder, axilla and thorax, washing them with ether, bathing them with a solution of 1-2000 of bichloride of mercury, and by the application of a moist bichloride dressing.

When ready for the operation the patient is brought to the edge of the table, the head and shoulder slightly raised and the arm of the affected side placed at a right angle to the trunk. The field of operation is surrounded by sterilized towels, the patient being thoroughly protected from exposure to cold. If the right breast is to be removed the surgeon stands upon the right side. Starting his incision at the apex of the axilla he carries it parallel to the anterior axillary fold and about one inch below it, until the border of the breast is reached. (Fig. 854). The knife is then swept around the breast, returning to the lower end of the axillary incision. The form of this breast incision will depend upon the size of the mass to be removed and the amount of integument diseased. If any of the skin covering the breast can be saved the incision should take the form of an eclipse, the center of which should be the nipple and the long axis of which should be parallel with the anterior fold of the axilla. If all the skin seems to be involved the cut may encircle the base of the gland.

The incision should be made through the skin and superficial tissue only, which should be rapidly dissected back until a border of the gland is reached. And here it must be remembered as shown by Hennig that the female breast is often irregular in form and that prolongations may reach the axilla and also lap over the sternum. If a simple circular amputation is made some of these processes may be cut through and portions left behind. If an uncertainty exists as to the possibility of having divided cancerous tissue the nitric acid method of Stiles may be employed. The tissue removed is thoroughly washed



Fig. 854. Line of Excision, Amputation of Breast and Axillary Gland.

in water until entirely free from blood. It is then emersed for ten minutes in a 5 per cent. solution of nitric acid c. p. It is again washed in running water for five minutes and then placed in undiluted methylated spirits. The effect of this procedure is to render all carcinomatous tissue of a dull white opaque color, while the fibrous tissue becomes gelatinous, translucent and homogeneous. The fat remains unaltered. Inspection, then, easily determines whether cancerous tissue has been divided or left exposed during the operation. The area of the breast having been determined, the incision is made down through the mammary fat to the pectoral muscle and the gland rapidly dissected off, together with the pectoral fascia, from below upward in the line of the pectoral muscle.

Nothing now remains but the attachment of the breast on the axillary side. The axilla is now opened by deepening the axillary incision and its contents inspected. To reach enlarged glands in the apex of the space or under the pectoral muscle, both pectoral muscles may have to be divided. Although this causes additional hemorrhage it is better than working in the dark or leaving infected tissue behind. The divided muscle may afterward be united by sheep-gut sutures. Having exposed the axillary vessels or the commencement of the subclavian the contents of the cavity are carefully cleared with the knife, the axillary vein being stripped absolutely clean. With this protected the remainder of the axillary contents may be rapidly removed from above downward, including the chain of lymphatics found under the border of the pectoralis major muscle. A portion of the axillary vein may be removed if found embedded in the cancerous mass, two chromic gut ligatures being applied. Lastly, this tissue, together with the attacked breast, is separated from the posterior axillary border and removed in one mass. During the operation the bleeding points are promptly secured with pressure forceps, which are allowed to remain until the breast has been removed. Exception should be made during the dissection of the axillary space. These vessels should be ligated at once, both because the forceps obstruct the operation and because the delicate tissue of the veins divided are easily torn, producing troublesome hemorrhage. By removing the breast and axillary glands in one mass the vessels entering the breast are divided but once, and the hemorrhage so frequently met with at the posterior

axillary border is largely avoided; the subscapular vessels necessarily divided are thoroughly exposed and readily caught. By this method no portion of the chain of lymphatics extending from the breast to the axilla is missed. The bleeding points may now be dealt with. In the majority of cases the long continued pressure of the forceps will suffice to close the vessels. In a few instances, especially where muscle has been divided, sheep-gut ligatures should be applied. All hemorrhages having been controlled and the wound made perfectly dry the skin should be

accurately apposed by interrupted silk-worm gut or a continuous sheep-gut suture. (Fig. 855). To secure this without tension relaxation stitches and buttons may be applied if necessary.

Drainage should be provided for by making an incision through the posterior axillary fold and the introduction of a drainage tube into the axillary space, thus reaching the deepest portion of the

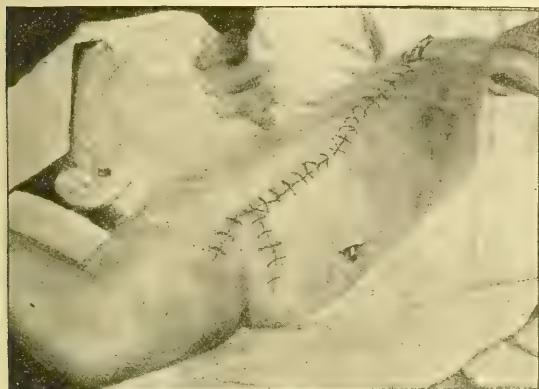


Fig. 855. Line of Suture, Mamma-Axillary Gland Amputation—Shears.

wound. If the area denuded is too large to be covered by simply stretching the skin the integument should be dissected back for some distance,

and being thus free from the sub-integumental tissue it may be the more readily stretched over the raw surface. If this fails a flap of skin may be turned up at the expense of the flabby abdominal walls, or the incision may be extended in a curved linear way around the side to the back and the flap slid up to cover the defect, a plan often practiced with success. The ingenious methods suggested by Macdonald may be followed if the conditions permit. He advises when the entire gland and skin have been removed to the external margin of the other breast that the remaining gland, if it be long, mobile and pendulous, be subsected, thinned out, drawn across the sternum and made to cover the denuded area. If these plans fail resort should be made to skin-grafting, the patient's thighs furnishing the material. In one instance the author used the skin of a large pendulous, fatty tumor, which he had amputated on the same day. Any of these plans are better than subjecting the patient to a long, tedious process of granulation; at the same time a more useful arm results. The wound having been closed, cleansed and all oozing prevented by firm pressure, iodoform



Fig. 856. Dressing After Amputation of Breast.

powder is dusted over the line of incision and into the axilla, iodoformed gauze applied and over this a large sterilized dressing protected by gutta percha tissue; the dressing is held in place by a firm bandage around abdomen and chest, the arm brought to the side with the forearm across the chest and secured there by a few turns of the bandage around the thorax and arm and over the shoulder and forearm. (Fig. 856). The wound is re-dressed in twenty-four hours and not again until the expiration of one week, at which time the sutures of the silk-worm gut are removed. A third dressing is usually all that is needed.

The beneficial influence which has followed the application of arsenic in the more superficial forms of cancer has led to its frequent internal use in the second or third potency after the removal of the cancerous mass, if no other constitutional remedy is strongly indicated.

SECTION XXIX.
PLASTIC SURGERY.

CHAPTER I.
GENERAL CONSIDERATIONS.

Definition.—Plastic Surgery is intended to indicate a process of management for the correction of deformities, the restoration of lost parts, and the suitable apposition of surfaces for repair where there has been a break of continuity in soft tissue from any cause.

The principle underlying the subject is one of the most important in the whole domain of surgical practice. The gist of the matter was included by the older authors under the term, “Adhesive Inflammation.” They described inflammation as a process having four stages: Adhesive, suppurative, ulcerative and gangrenous. Of these stages the adhesive was supposed to be of the first importance to the surgeon in all efforts to correct deformities, repair lost parts, and for the restoration of integrity to parts suffering from incisions or lacerations. It was styled, “Union by the first intention.”

History.—Traces of crude knowledge of plastic surgery may be found in the most primitive stages of medical history. Gross says in India the practice of rhinoplasty runs back to a date almost immemorial, where amputation of the nose has from the earliest times in the history of the country been one of its penal modes. Egyptian, Grecian and Roman history bear evidence of some knowledge in the art. Three hundred years ago, or more, there lived in Bologna a practitioner by the name of Casparo Tagliacozzi (afterward called Gasper Taliacotius) who made a profound impression by his cures and treatment of certain bodily defects and deformities. His skill and success in practice, together with his adroit concealment of his particular methods, brought him by turns reputation as a sorcerer, necromancer, liar and boaster. He was finally made professor of anatomy and medicine in a college of Bologna where he added to his reputation as a skillful operator, and died in great favor with his students, his memory being commemorated in a marble statue exhibiting a hand with a nose ready for application.

In process of time the subject was taken up and further illustrated with great ability and industry by such honorable names as Liston, Diefenbach, Baudin, Seis, Von Ammon, Serre and Carpus, in Europe, and by Pancoast, Muetter and Warren in America. But of all these the Bologna operator was undoubtedly the most progressive and daring.

His students carried and disseminated his views and teaching everywhere, but from fear of failure seem for a time to have attempted little practice.

John Hunter, England's natural-born surgeon and physiologist, gave his help and influence in favor of plastic surgery. He is reported to have made a most unique and striking illustration by removing a part of a comb of a young barn-yard cock and transplanting instead the young undeveloped spur, where it found abundant blood for nourishment and so grew and prospered wonderfully.

Conditions for Success.—Full and complete success in plastic operations must be attended by certain important conditions.

First. The general health of the patient should be in the best possible condition obtainable. In a large majority of cases there is no necessity for haste. If necessary, weeks and months had better be consumed for this purpose than run the risk of an operation in the possible face of any taint from syphilis, tuberculosis, cancer or faulty nutrition in any form. Circumstances may arise where this rule cannot be absolutely observed. It is commonly approximated at times where delay might be worse than its violation. Then, too, primary union can be obtained even in these diathetic conditions, although they demand the strictest exclusion of suppurative influences.

Second. Absolute surgical cleanliness of the patient, the nurses, the surgeon, the instruments and dressings. If the operation is to be performed in a private house it may be necessary to remove the carpets and scrub the floors and walls of the room at least a day before the operation.

Third. Immobility of the part under management by means of the various borated cottons, wools and oakums, which serve a most valuable use in this phase of surgical procedure, and aid in securing exclusion of unwholesome atmospheric influences.

Fourth. As the highest grade of vitality will conduce much to success plastic operations, other considerations obtaining, should by preference be undertaken between the ages of ten and thirty-five years, at a time when vitality is stronger than in early infancy and old age. An exception to this rule may be required in hare-lip, with such deformity as to be very disfiguring in appearance and interfere with the prehension and reception of food; authorities are somewhat at variance as to the age for this operation, fixing it between the first week and the fourth or sixth month.

Fifth. As consent and co-operation of the patient will be elements of great importance, anesthetics will in some cases be inadmissible, an exception being usual in hare-lip operations.

Sixth. As the accomplishment of the foregoing conditions can be commanded in a well-regulated hospital far better than in any private home or residence preference should always be given the former.

The plastic process in surgery has so rapidly extended and expanded in all directions within the last half of the present century as to make it inexpedient within the limits of the present volume to embrace the whole subject as to authorship and operation in detail. It is proposed, therefore, to devote special attention to rhinoplasty, skin-grafting, hare-lip, cheiloplasty and cicatricial deformities, each and all in the hands of the skilled operator furnishing examples of most gratifying results.

CHAPTER II.

SKIN-GRAFTING.

Origin.—This is an ingenious and successful process for repair and cicatrization of large obstinate ulcers and open wounds. In looking over the recent literature on the subject the surgeon finds advice obscured and counsels darkened by profuse accounts of the modes and modifications as practiced and taught by the various authors and teachers who have given the subject attention. As in the case of Deadrick, of Tennessee, who excised the jaw, and McDowell, of Kentucky, who performed the first ovariectomy, so in skin-grafting, Americans claim priority for one of their own countrymen in the person of Hamilton, of New York, who first proposed the operation about 1847. His first practical success was accomplished about 1854, when one Horace Driscoll, with a large ulcer of the lower extremity obtained entire relief and cicatrization of the part in ninety days by transplanting a flap of integument from the opposite leg. When American ingenuity had given hint and motion an astute Frenchman, Reverdin, was quick to appreciate the idea and rapidly pushed on to further practical successes.

There was at one time a distinction between epidermic and cuticular grafting. Marc Lee, of Paris, and Boland, of London, proposed and advocated a plan which consisted in scraping off epidermic particles from healthy skin to be scattered over the surface to be repaired; but results were not satisfactory and the practice has fallen into disuse.

The Operation.—Stripped of unnecessary verbiage and peculiarity of individual ideas, the process consists essentially in placing small particles of healthy skin upon the well-renovated surface to be repaired. Large pieces of skin, several inches square, have been successfully transplanted; but it seems to be the consensus of opinion that the smaller particles adapt themselves to the new surroundings and “take root” more readily than the large pieces. The grafts may be taken from the patient’s own person, or from the body of some other who may be willing to render service of the kind. The surface upon which they are to be placed should be gently but thoroughly renovated with warm sterilized water. The grafts should be about the size of a millet seed, and while they do well if they include the entire depth of the skin they do equally well if they include about half the skin thickness, only so thick as to have vitality and yet not thick enough to draw much blood or give much pain to the contributor. Then, too, the small bits taken do not leave an unseemly scar that might follow a larger contribution, to say nothing of the pain attending the removal. The entire “graft” for a given case may be accomplished at one sitting unless the surface be very large, in which case one or several sittings may be observed. The grafts should be placed about equidistant from each other and from the margin of the open surface. No sacrifice or preparation of the surface is necessary other than careful renovation. The grafts should be held in

place by Lister's protective strips, or, preferably, sterilized gauze cut into narrow strips and laid across the grafts in a right-angle form, leaving spaces between for the outflow of any secretion that may appear; upon this is placed more sterilized gauze, with borated cotton above and a roller over all. At the end of three days the dressings should be carefully removed and the grafted surface gently irrigated by a stream of tepid water falling from a perfectly clean sponge or bits of borated cotton. When seen after irrigation they appear considerably diminished but present evident signs of vitality and adhesion if the process be a success. The part should be re-dressed as before and so continue under re-dressing every three or four days.

When the grafts "take root" and do well they reach out toward each other and the margin with remarkable rapidity, sometimes two or three of them making a sort of joint movement and progress and so extending across the ulcerated surface as to cut it into two or more compartments. But most remarkable of all, the heretofore indolent margins take on new life and reach for the grafts. Experiments go to show that almost any animal integument may be made to furnish grafts, but undoubtedly the best source of supply is the human integument. The cicatricial surface obtained by grafting is puckered, purple or livid at first, but gradually improves and assumes a presentable appearance in from four to six or twelve months. In the case of a man where the whole anterior surface of the forearm from the elbow to the wrist had been raw for many months from the effects of a burn, and despite unremitting treatment of various kinds, even Reverdin's method of skin-grafting having been employed without any beneficial result, the author had admirable success by covering the parts with a flap taken from the back and side. After a complete antiseptic cleansing of the skin and sore the thickened edges of the injured surface were thoroughly removed, leaving good healthy borders to which the flap was to be attached. The pouting granulations were then scraped away under an irrigating stream of a six per cent. salt solution, and the exposed surface covered with a saline cloth. The exact size and shape of the abraded surface were obtained by laying a cloth dipped in the salt water upon the back and side and cut accordingly, the posterior edges being one and one-half inches from the spine, and the arm placed in the position it was to remain in after the operation, lying upon the anterior edge of the cloth and firmly bound there by turns around the body of plaster of Paris rollers affixed at the wrist and hand and from the elbow to the shoulder. Firm pads of soft muslin were previously laid between the wrist and hip and elbow and side to prevent the pressure of the arm upon the raw surface made by the removal of the flap.

Marking the posterior and lateral boundaries three-fourths of an inch larger on each side than the model, to allow for contraction, the posterior edge was drawn forward beneath the arm, and then carried over the wound and held there until the exact points to which the incisions should extend anteriorly were determined. The flap thus marked out was dissected up and placed upon the arm, to which it was sutured by fine silk. (Fig. 857.)

It will be seen that no stitches were taken on the anterior line of the junction of the flap and border of the ulcer, apposition being made by a light compress of iodoform-gauze placed along the entire point of

approximation. The dressings consisted of iodoform sprinkled over the edge of the wound, iodoform-gauze, bichloride gauze, rubber protective, absorbent cotton and roller bandage, the latter passing around the body and covering the dressing on the wound on the back, which was similar to the above. On the second day the dressing was removed and reapplied, the wound showing every appearance of a healthy, established union between the flap and borders of the ulcer. The flap was severed from its connection with the body on the seventh day, union at that time being perfect.

This plan can be made applicable to large wounds of the upper arm or hand, or leg. In case of the latter the legs may be made to lie close alongside of each other, or crosswise if necessary to bring the flaps into an easy and proper position.

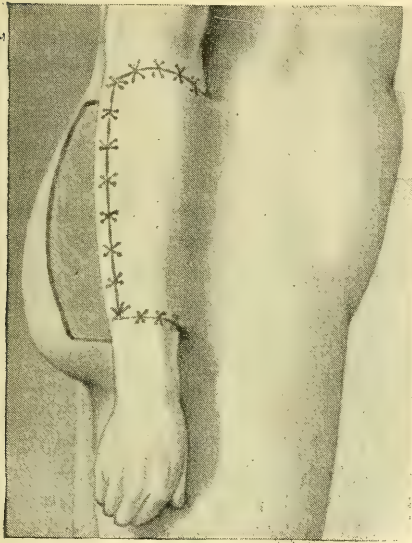


Fig. 857.
Skin-Grafting.—Parsons.

REVERDIN'S METHOD. The surface of the ulcer to be repaired, as well as the adjoining skin, should be made clean by gentle ablution, and dried by gentle pressure from flakes of carbolated cotton rendered aseptic. The point of a perfectly clean needle should be used to elevate the skin which is to furnish the graft. The graft should be shaved off with a thin, sharp scalpel, or cut off with a delicate, sharp-curved pair of scissors. To insure an active epithelial layer a thin portion of the derma should be included. The graft is placed gently, cut surface downward, on the granulations by means of a needle, avoiding any handling or pressure likely to make the granulations bleed. The

requisite number of grafts having been placed, they should be protected by a thin layer of gutta percha or sterilized gauze, which should extend beyond the ulcer margin by about two inches, interlaced in such way as to furnish protection while allowing any serous or purulent excretions to escape. Over this protective a light compress of gauze wet in salt solution should be placed, over this a layer of oiled silk, and then a pad of absorbent cotton, and, lastly, a gentle bandage. If the parts be mobile a thin plaster of Paris or silicate of sodium bandage may be called for to insure quiet with an infant or young child as a patient. In twenty-four to forty-eight hours all dressings except the lattice work of protective should be removed and the part gently irrigated with a warm salt solution, after which the first dressing should be repeated, and be repeated from time to time as may seem to be needed till the end of a week, when the entire dressing should be removed for inspection of the grafts. If necessary the dressing should be renewed. In many instances the grafts shed their cuticle, which floats off with the discharges, leaving the skin germ in an apparently unpromising condition; but at the very next dressing and inspection appearances of a new epidermis will present

in a bluish-white spot or point with marked evidences of vitality and growth. As the grafts spread eccentrically and each has a capacity for about one-half inch of cicatrix, they should be placed about a half inch apart and an equal distance from the ulcer margin. Where the ulcer margin is irregular the grafts should be placed in rows so as to cut the surface up into triangular and irregular figures, in the arrangement of which a little ingenuity may so manage matters as to economize the number of grafts and by so much diminish the amount of pain in furnishing the grafts. The spots from which grafts have been taken may be treated by dusting them over with iodoform, to be covered with absorbent gauze, cotton and a bandage, which dressing should be allowed to remain for ten days.

It may be questioned whether Reverdin's mode might not have a better and more uniform success if unattended by his complication and elaboration in dressing. The best success would seem to have been attained with an after-dressing so simple as to serve the purpose of avoiding friction and too much atmospheric contact.

THIERSCH'S METHOD. Complete asepsis having been accomplished by washing the parts with an antiseptic agent the field should be re-washed with salt solution to remove any remnant of the antiseptic; the soft, imperfect granulations, including any imperfectly healed margins, are scraped away with a sharp spoon, and the bleeding surface irrigated and made dry by gentle pressure, to repress oozing. Any portion of skin relatively free from underlying fat, preferably the arm or thigh, having been shaved and sterilized, may be selected as the graft supply. The skin being drawn taut by one hand, with the other a long, wide razor or microscopic section knife is applied flatwise and the outer layers of the skin shaved off by a sawing motion of the blade, which is kept under constant irrigation with the salt solution. Each graft should be as broad and long as possible, and be immediately placed upon the new place of residence by floating from the knife under motion of a salt solution stream. A dexterous use of a sterilized probe may be made to answer a good purpose in the matter of floating the graft from the blade. Any needed correction of position may be accomplished by the use of the probe or a camel's hair brush. Each graft must be pressed into its place with a spatula and must be in contact with its neighbor, better if slightly overlapping its fellow and the margin of the ulcer; otherwise suppuration of the grafts may occur, commencing at the edges, or spreading ulceration may happen. Thiersch's dressing and after-management are almost identical with Reverdin's, except not quite so elaborate and complicated, and to this extent doubtless preferable. A marked difference between Reverdin's and Thiersch's mode of operating is seen in the fact that the former places his grafts half an inch apart, and equally far from the ulcer margin, while the latter directs their overlapping at all points.

Encyclopedic Summary.—First. Skin-grafting affords an admirable means of accelerating and facilitating cicatrization.

Second. The pellicle produced by its aid is less prone to contraction and contracts less than the ordinary cicatrix.

Third. The deep layers of the epidermic elements are the chief factors of growth.

Fourth. The growing cicatrix is formed at the expense of the

embryonal cells of the granulating surface, stimulated into activity by the presence of the living cells of the graft.

Fifth. The stimulus first showing energy in and around central islands of new growth induces similar activity in the hitherto dormant margin of the ulcer.

Sixth. Grafts may retain vitality and be effective long after being separated from the body.

Seventh. Small grafts, of the size of millet seeds, for example, are in general preferable to larger; although larger grafts, one-fourth inch square (Donelly), or even eight square centimeters (Ollier), have their advocates and success.

Eighth. Grafts should be obtained from the patient himself if possible, and in all cases the danger of specific inoculation ought to be present in the mind of the surgeon who borrows grafts from one subject for application upon another, or who practices heteroplasty.

Ninth. Grafts furnished by the aged are less disposed to adhere than those procured from the young, the former sometimes failing entirely.

Tenth. Grafts obtained from one race of men may be successfully used on individuals of another race; an animal graft may be transplanted upon human beings, adhere and provoke cicatrization.

Eleventh. Foul surfaces, or those of persons in bad health, will refuse to accept good grafts; but with improvement or establishment of the health of the individual bearing an ulcer, and the appearance of healthy granulations, a favorable result of skin-grafting may be anticipated.

Twelfth. Finally, the great benefits accruing from successful skin-grafting far outweigh its drawbacks, which are the pain of the operation, and, unless amputated limbs be utilized, the consecutive pain in the parts yielding the grafts, whether, of course, these be autoplasmic or heteroplasmic.

CHAPTER III. METHODS OF FLAP FORMATION.

To Close a Triangular Gap.—If the gap be small and form a triangle the area may be closed by uniting the sides or angles of the triangle. A larger gap may be closed by carrying an incision along one or both sides of the base and in a line with it. The flap or flaps should

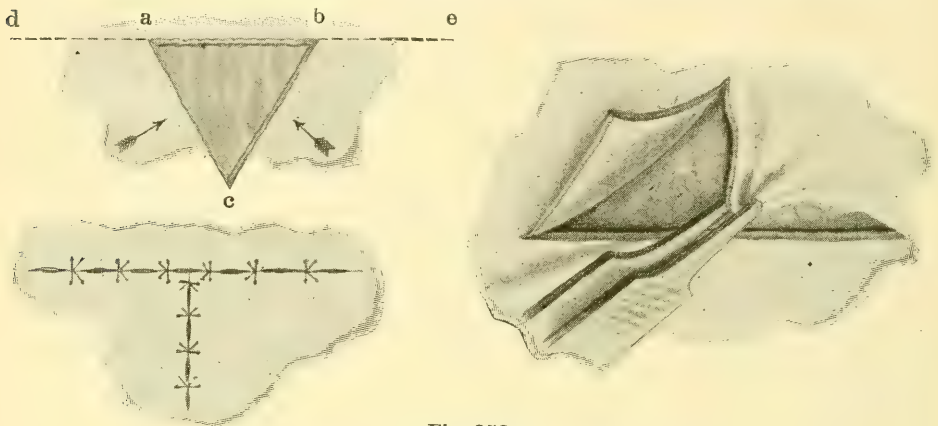


Fig. 858.
Lobker's Operation for Closing Triangular Gap.

be dissected up, d to a and b to e, and brought together so as to unite a to b. (Fig. 858). (Lobker.)

JAESCHE'S OPERATION. This is another method for closing a triangular defect. The object of the curved incision is to conform with the natural arrangement or movement of the tissues or features or

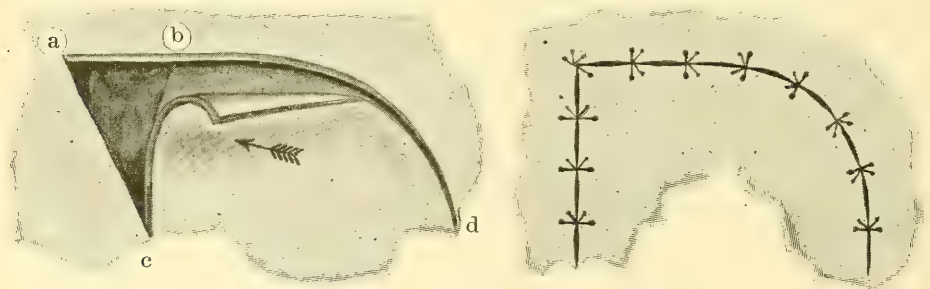


Fig. 859.
Jaesche's Operation.

to avoid a nutrient vessel. Starting from one side of the base of the triangle a curved incision is made, the lower end of which is on a level with the apex of the triangle. The flap is dissected and attached, b to a. (Fig. 859.)

DIEFFENBACH'S METHOD: Also for closing a triangular gap. This consists in the formation of a square flap by making an incision along the base line of the defect and then downwards at an angle in conformity with the corresponding line of the defect, a to c, b to d, as the apex of the

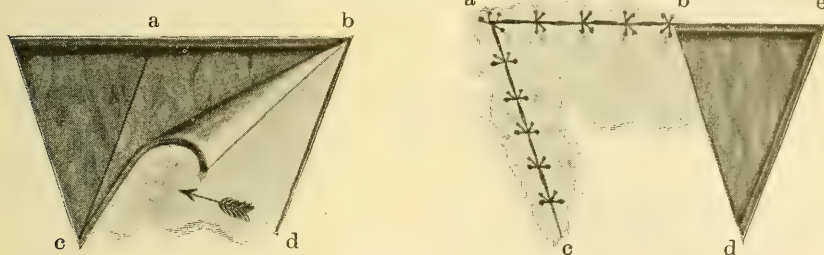


Fig. 860.
Dieffenbach's Operation.

triangle. The length of the incision along the base line should be the distance from the base to the apex of the defect. The flap being loosened should be displaced and stitched over the gap, a b, c a, leaving the raw surface, b, d, e, to close by granulation. (Fig. 860.)

BUROW'S OPERATION: For covering a triangular gap. Burow's

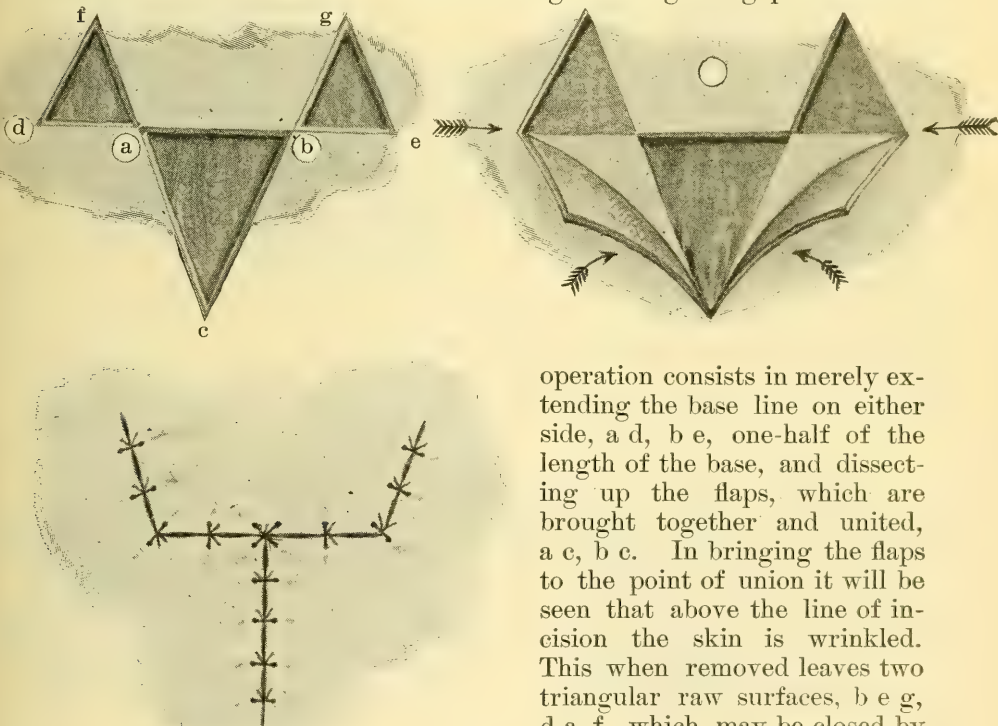


Fig. 861.
Burow's Operation.

operation consists in merely extending the base line on either side, a d, b e, one-half of the length of the base, and dissecting up the flaps, which are brought together and united, a c, b c. In bringing the flaps to the point of union it will be seen that above the line of incision the skin is wrinkled. This when removed leaves two triangular raw surfaces, b e g, d a f, which may be closed by a few stitches. (Fig. 861.)

To Close a Quadrilateral

Defect.—Two parallel incisions in continuation with the longer margins of the wound are made on either side of the gap to be covered in, e a, f c, b g, d h. The two flaps, e a, f c, b d, g h, are detached and united

along the margins, a c, b d. In some cases one flap may be sufficient. (Fig. 862). (Lobker.)

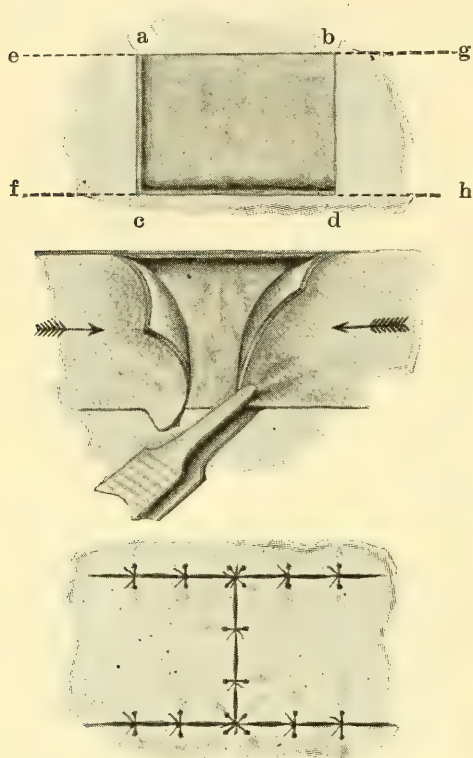


Fig. 862.

Lobker's Operation—Closing a Quadrilateral Defect.

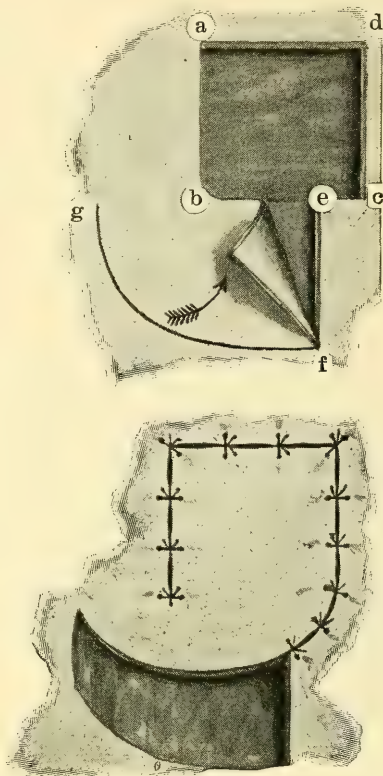


Fig. 863.

Letenneur's Operation.

LETENNEUR'S OPERATION. To closing a square gap the flap b e f g (Fig. 863) is dissected from below and is carried upwards until the margin e f can be sutured to margin a d.

BRUN'S OPERATION. This is another method for covering a quadri-

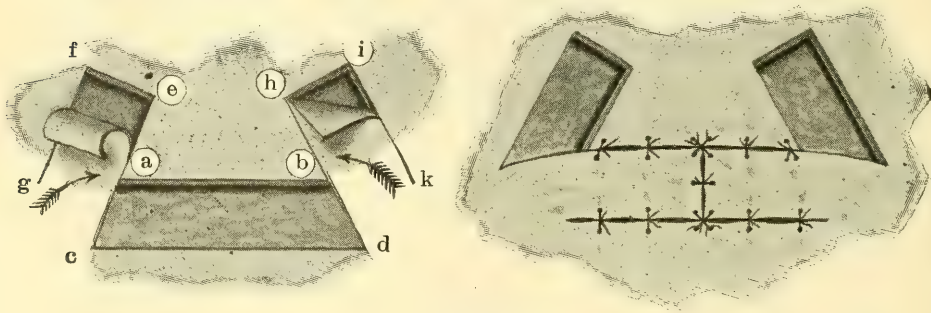


Fig. 864.

Brun's Operation.

lateral gap. Two lateral flaps a e f g, b h i k, (Fig. 864) are marked out, dissected up and so brought together that the borders e f and h i are united in the median line.

Elliptical Defects.—These may be closed by either of the following operations: Curved flaps, as outlined in Fig. 865, a c d e, b c d f,

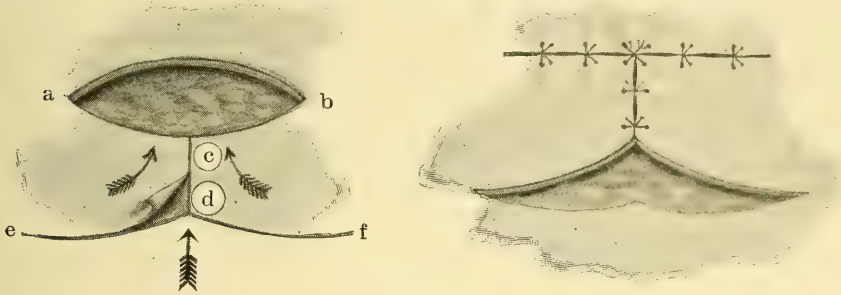


Fig. 865.
Curved Flaps in Elliptical Defects

may be cut and freed by dissection and then brought up to cover the gap.

WEBER'S OPERATION is employed for the same purpose as the last. Two flaps, a c d and b e f, are cut out as shown in Fig. 866, and after subcutaneous detachment may be so adjusted that the point c of the flap

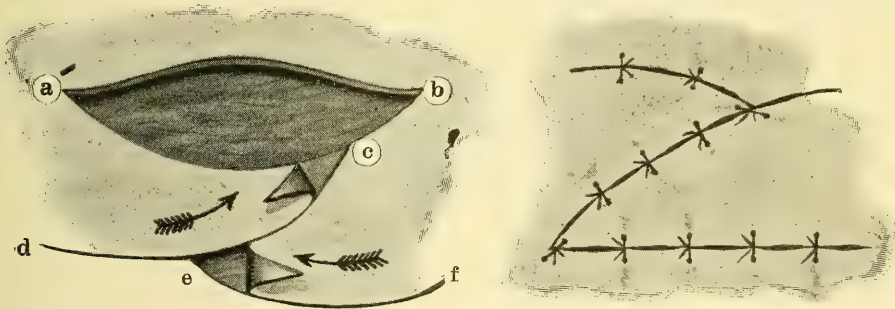


Fig. 866.
Weber's Operation.

a c d is carried up to and attached to the angle b, while the gap by its displacement is closed by the second flap, b e f. Fig. 867 is another method for closing elliptical defects.

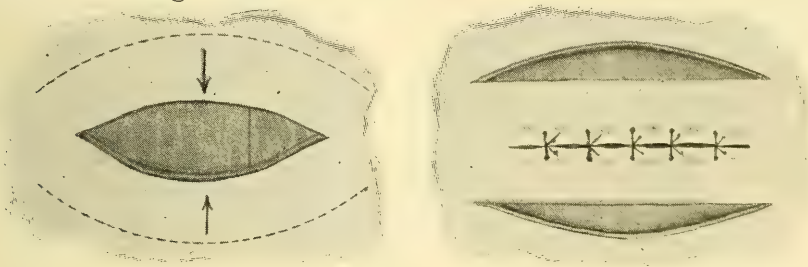


Fig. 867.
Another Operation for Elliptical Defects.

Rhinoplasty.—This operation is intended to supply defects or restore the nose, whether the loss be from traumatism or the ravages of malignant disease, usually epithelioma, syphilis or lupus.

The two principal methods of operating have been that of Tagliacozzi,

who obtained his flap from the patient's left upper arm over the biceps muscle, and the Indian plan, which obtains the flap from the patient's forehead—the latter being the one now chiefly in vogue. The constrained attitude of the patient and the tedium of the process under the Tagliacotian mode furnish serious objections as compared with the Indian mode. The nasal organ is subject to a great variety of partial defects and losses which must be provided for according to the nature and extent of the defect. In some of these minor defects small flaps may be obtained from the cheek, lip or the nose itself.

THE OBJECT. The contemplated object may be for partial or complete restoration of the injured organ, according to the extent of the damage.

CONDITIONS. Very early life, infancy, old age, infirm health, specific taint, or the presence of epidemic disease are conditions unfavorable to success.

SOURCES OF FAILURE. These are erysipelas, hemorrhage, gangrene and non-union of the prepared surfaces.

DRAWBACKS. Such may come from a bulbous, misshapen, unsightly organ, or from unexpected shrinkage, making the organ quite too small for the space to be covered.

SUCCESS. This may be fairly predicted under favorable surroundings, and especially with advanced modes in asepsis and good hygiene, and with a better order of professional skill. But with all these to help it must be admitted that mortifying failure will sometimes result.

The literature of the subject gives two leading methods of operation—the Indian, the Italian. The first is so named from the country where it has been extensively practiced from a remote date. The second is named from the country in which the originator, Taliacotius, resided. The French operation is simply a modification of the Indian. Sundry other operations which are not modifications of the Indian and Italian have been proposed and practiced.

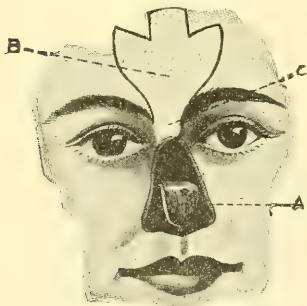


Fig. 868.

Rhino-plasty.

a. Nasal Flap.

b. Frontal Flap.

c. Pedicle of Frontal Flap.

The Indian operation with its various modifications is more frequently practiced than either or all of the others, as being less painful, using less constraint and requiring much less time. (Fig. 868.)

One of its chief drawbacks in successful cases is the unseemly cicatrix left in the site (forehead) from which the flap is taken.

Under any mode of operating every precaution should be taken toward the sanitation, hygiene and improved health of the patient.

THE INDIAN METHOD. This method having been decided upon, a mould of wax, gutta percha or dough should be made representing the exact size and shape of the new nose. Over

this a piece of wet leather should be spread in order to get the exact size of the flap, including the column. Another piece of leather, one-third larger than the former, is then fashioned, this addition being necessary to provide against shrinkage. The shape and size of the flap, as indicated by the leather model, should be outlined on the

part from which it is to be taken with ink or tincture of iodine, the middle of the forehead always being preferred unless there be some circumstance to contra-indicate, in which case it should be taken from one side.

The preliminaries being settled, the patient lies in the recumbent posture, with head and shoulders slightly elevated, and is placed under the influence of chloroform. A roll of lint should be inserted in each nostril to prevent the ingress of blood. The first incision should be made along the iodinated line with a very sharp, narrow scalpel. The cut on the right side is extended along the brow and down to the root of the nose, while on the left side it reaches hardly so low as the level of the brow, being prolonged afterwards if deemed advisable.

In performing this part of the operation care should be taken not to interfere with the angular artery, as the vascular supply to the new nose will depend upon its integrity. The integument should be divided at one stroke down to the periosteum, which should be left intact. The flap should be hastily dissected down to its pedicle, immediately after which steps should be taken to arrest any hemorrhage, in order to draw the opposite margins over the denuded surface, to be fastened by sutures, as small a space being permitted to remain open as possible.

The next step in the operation will consist in paring the edges of the mutilated organ and the removal of any redundancy or excrescence likely to be in the way of the new material, with a slight freshening of the bridge, if any remain, to facilitate adhesion. The frontal flap is now brought down, twisted upon its pedicle and sutured into its new position by from three to five sutures of sheep- or worm-gut on each side. It now remains to fix the caudal portion of the flap intended for the column into its position, a proceeding requiring the greatest care and dexterity in order to secure its adhesion, and upon whose special success the general success of the operation will largely depend. If space and material allow the column should be provided for along with the flap from the forehead; otherwise it must be provided from the upper lip at once or at some future stage of the operation. The inquisitive, industrious student will find in the literature of the subject a free discussion as to the relative and absolute advantages of flaps by Langenbeck, Koegan and Dieffenbach. These distinguished authors and operators are quite agreed among themselves and with the profession generally in everything except the shape, size and management of the flaps and the column.

The lint inserted into the nostrils prior to the operation is now replaced with fresh bits enclosing gutta percha tubes to prevent adhesions of the opposite surfaces as well as to facilitate respiration. Narrow strips of protective plaster being stretched across the sides of the nose so as to effect more uniform approximation, the dressing is completed by applying a layer of sterilized gauze or cotton, the whole to be covered by layers of iodoform-gauze. With the greatest care the parts should be held in position, but with equal care tension or stretching should be avoided.

The diet should be light and cooling for the first day or two, and longer if the temperature be elevated. The head and shoulders should be raised by a suitable adjustment of pillows. Much pain after the operation may indicate the use of an anodyne, but usually the suitable administration of arnica or aconite or belladonna will meet the internal administrative needs.

If matters progress well the dressings should not be interfered with until the third or fourth day, when new tents will be inserted into the nostrils and any loose sutures removed; otherwise they are not disturbed. Any puckering or exaggeration of parts should be regulated by pressure

as may seem indicated. The pedicle is separated about the third or fourth week. Any wrinkled or redundant portion of skin which marks the position should be removed in the form of a wedged-shaped piece to prevent a parrot-shaped nose.



Fig. 869.
Italian Method of Rhinoplasty. Cuirass for Keeping Arm in Position.

THE ITALIAN OPERATION. (Fig. 869).

This operation has undergone several important modifications. As originally executed by Taliacotius and afterwards by his immediate followers it was a most trying, tedious procedure, well calculated to put severely to the test the patience of both the subject and the surgeon. The first step consists in forming a suitable flap of integument at the inner and middle part of the left arm over the flexor muscle, at least four inches in length by three and one-half in width, its outlines having been previously marked off with ink, or a sterilized pencil. Two longitudinal incisions being made, the integument is carefully raised in its entire extent, or as far as the two transverse lines, and a piece of soft linen well-oiled is afterwards passed beneath

to prevent reunion. The wound, which in the modern process is closed by suture under the bridge, is left to suppurate, and at the end of a fortnight the flap, now thickened, hardened and shrunk by exposure and covered by granulations on its posterior surface, is liberated at its superior extremity, which is then accurately stitched to the mutilated organ, whose edges have previously been revived for its reception. To prevent the sutures from giving the limb is brought up close to the head and maintained in that position by an ingenious but complex apparatus consisting of a cap and jacket made of strong drilling, the arrangement and mode of application of which may be understood from Fig. 869. Another fortnight having been permitted to expire to afford the parts time for uniting, the flap is detached from its connection with the arm, after having been properly fashioned, accurately fixed in the position which it is destined to occupy, and held gently by sheep-gut sutures.

Taliacotius left no statistics of his rhinoplastic operations, and, therefore, ignorance exists with regard to his success. From the great care, however, with which he described his process, and from the fact that he attended numerous patients from abroad, it is reasonable to conclude that his success was highly flattering. He was evidently a most ingenious and skillful surgeon, far in advance of his age. In the operation of constructing noses he dwells with great force and point upon the importance of having the flaps of unusual dimensions, thus providing against the effect of shrinkage, one of the great obstacles to the formation of a good organ.

Graefe, of Berlin, modified the operation of Taliacotius by attaching the flap at once to the mutilated nose, thus limiting the period of the constrained position of the head and limb to five or six days, this being generally found sufficient to secure adhesion between the parts. The actual value of this process, now usually known as the German method, has not been sufficiently tested, but the consensus of opinion is that while it answers very well in some cases, it is, on the whole, inferior to the original, since it lessens the chances of reunion and admits of a greater degree of shrinkage after the operation. In the Italian procedure the new material, from its exposed situation, acquires a better circulation as well as a greater degree of solidity and thickness, thereby fitting it the better for maintenance of the new relations.

CHAPTER IV. PARTIAL RHINOPLASTY.

General Considerations.—These operations are numerous and consist in simply carrying out the general principles governing the reconstruction of an entire new organ. Defects in the central part of the nose—the root and lower third being quite sound—may be remedied by the gliding method or by means of definite lateral flaps derived from the integument of the cheek.

A new ala may be obtained by means of a quadrilateral flap from the opposite or sound ala. Weber obtained repair material from the upper lip for a new ala under much the same rules and detail as for the production of a new columna.

Modifications.—Ordinarily the nasal column will be provided for in dissecting up the general flap. If for any reason, as from a very low forehead, this provision has not been made the supply may be obtained from the upper lip. In this process the coronary artery should be carefully guarded; in the male subject the hair glands should be dissected off, as a hirsute growth in the locality would prove neither useful nor ornamental. After the column has been fixed in position the gap in the lip should be closed by sutures. Volkmann, Bennett of Dublin, and others are opposed to the separate special columna. They point out that the contraction of the deep surface of the frontal flap leaves an orifice none too large for the admission of air. The flap is allowed to hang freely downward, and its extremity is not secured by sutures. The contraction of the flap leads to the formation of a definite tip to the new nose, the appearance of which, it is claimed, would not be improved by a columna.

Artificial supports of gold and amber to support the nose when inclined to sink and flatten produce irritation and have been voted a failure.

THIERSCH'S OPERATION. Thiersch dissected up two little flaps on opposite sides of the nasal position which he drew towards each other with sutures, and then brought down his main flap from the forehead over this as a support, which plan seems to work well.

LANGENBECK'S OPERATION. With a fine saw Langenbeck cut lateral layers of bone and periosteum which he drew toward each other as a sort of bridge support.

NELATON'S OPERATION. This consists mainly in the dissection of a flap from the cheek on each side of the nasal organ, and with a pedicle at or near the lacrymal sac while their bases are below. Each flap contains all the soft parts down to and including the periosteum which is stripped off the exposed portion of the ascending parts of the maxilla on either side. The flaps are sutured together along the median line, and



Fig. 870.
Nelaton's Operation.
Method of Rhinoplasty.

are attached also by their outer margin as in Syms' procedure. The results of this operation have not been very satisfactory.

WOOD'S OPERATION. This consists in taking a large flap from the upper lip. The mucous membrane and the hair glands being removed, the flap is carried up over the nasal position and fixed by sutures to the upper nasal margin, while lateral flaps from the cheek were brought together so as to close up the denuded area and give support to the new nose. Experience with the operation has not been quite satisfactory.

OLLIER'S OPERATION: Applicable for extensive loss of the nasal organ after lupus, in which the integument of the lip and cheek is so damaged that it could not be used for repair. Ollier begins by two di-

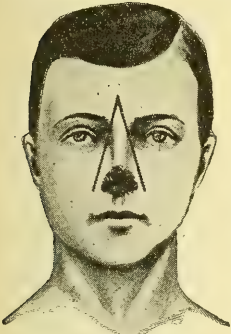


Fig. 871.
Ollier's Operation.

verging incisions, starting in the median line of the forehead two inches above the eyebrows and carried down to within one-fourth of an inch of the outer side of the nasal orifice. The upper portion of the triangular flap includes the corresponding portion of the periosteum down to the upper end of the nasal bone. The dissection is continued along the right nasal bone, omitting the periosteum, down to the lower end, from which the cartilage is separated but remains attached to the flap. The left nasal bone is separated from its bony connections with a chisel, leaving it attached to the flap by its anterior surface. The cartilaginous septum is then divided from before

backward and downward with scissors, and left attached by its base to the cutaneous cartilage, that a central support may be provided for the new structure. The whole flap is drawn downward until the upper border of the loosened nasal bone (left) comes opposite the lower border of the right one, when they are fastened together with wire sutures. The sides of the flap are then united to the cheek and the frontal incision closed above its apex. In this case it is said the bone loss on the left is replaced by bone developed from the periosteum brought (slid) down from the forehead (Fig. 871.)

VERNEUIL'S OPERATION. An incision is made vertically along the median line of the depressed nasal organ. At each end of the incision, that is at the root of the nose and just above the alæ, a transverse cut is made. The two nasal flaps thus marked out are dissected up. A comparatively small oblong flap is now raised from the middle of the forehead, its pedicle being placed between the two inner canthi. It is turned downward—without torsion of the pedicle—so that it closes the large opening made into the nasal fossæ by the dissections of the nasal flaps. The raw surface is anterior or external, the cutaneous surface looks toward the nasal fossæ. The flap is fixed in position by sutures. The nasal or lateral flaps are now drawn over it and united in the median line. The wound in the forehead is closed as far as possible by means of sutures and a hare-lip pin, and the granulating surface left is subsequently grafted. The pedicle of the frontal flap will, at a later

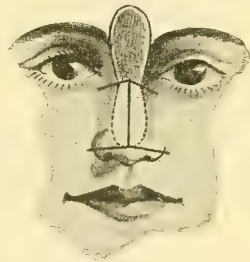


Fig. 872.
Verneuil's Operation.

period, require division and trimming. Jacobson speaks well of this operation. (Fig. 872.)

New Ala.—DENONVILLIER'S MODE (Fig. 873). A pedunculated triangular flap is cut from the sound side of the nose, just above the ala.

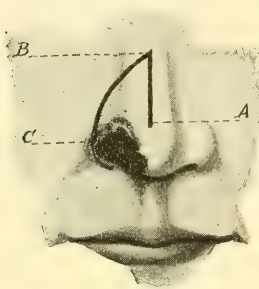


Fig. 873.

Denonvillier's Operation.

The pedicle is placed internally at the tip. The incision is commenced near the tip on the sound side and passed upward nearly to the root of the nose. (A—B). From the end of this a second cut descends obliquely to terminate at the upper and outer angle of the defect. (B—C). This flap is dissected up; its lower part should contain a strip of sound cartilage. It is finally displaced downward and fixed in position by sutures, the margin of the defect having been already freshened to receive it.

LANGENBECK'S OPERATION. The most convenient shape to give the flap is a quadrilateral one. From the upper and inner angle of the defect an incision is carried downward along the dorsum of the nose, nearly to the apex on the sound side. (A—B). A second incision is made parallel to the first and runs from just below the inner canthus to the junction of the ala with the cheek. (C—D). The lower ends of the two incisions are united by a third cut which runs along the free border of the ala. (A—C). The quadrilateral flap thus marked out is detached from the cartilage as far up as the line of its base. It is then drawn over and fixed to the freshened margins of the defective area. The defect left upon the sound side should be drawn together at its margins as far as possible, and when granulating should be freely grafted to prevent contractions.

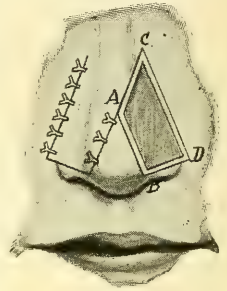


Fig. 874.

Langenbeck's Operation.

New Columna.—HÜETER'S OPERATION. A quadrilateral flap is taken from the dorsum of the nose. (Fig. 875). The pedicle of the flap is placed near to the tip of the nose, and its free border not far from the inner canthus. The periosteum of the nasal bone is detached along with the flap. The flap is transplanted by twisting the pedicle.

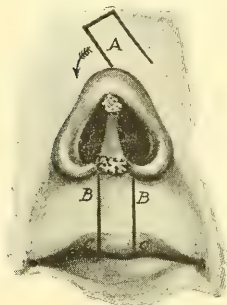


Fig. 875.

Formation of New Columna; A, from nose, B-C, from lip.—Hüeter's Operation.

AUTHOR'S METHOD: For making a bridge where the septum is destroyed. Various methods have been devised for keeping the nose in proper shape when, from syphilis or lupus or other cause, the septum has been completely destroyed, leaving the soft structures unimpaired. One operator resorted to the insertion of the breast bone of a chicken, covering it over with flaps from the cheek, the result being a flat failure. Another has employed a kitten's ribs sutured to the nasal processes of the superior maxillary bone, meeting in the central nasal line like the rafters of a house. Skin flaps were stitched over them, but they did not unite. The author once made a transverse section of a nose that had lost its partition, laying the anterior portion down over the mouth, and inserted a living piece of the

cartilaginous septum of a calf, after freshening all the parts it was to lie in contact with. No good followed the operation, and a strip of bone was then taken from the forehead and lain along the dorsum, making an excellent bridge.

The first step in the operation was to enter the knife in the center of the glabella, and carry the incision downward in a curved direction to the angle formed by the cheek and nose just below the eye on the left side, thence along this angle to the lobule of the nose and across the dorsum to the opposite side. The flap thus marked out was reflected back, care being taken to include the skin only. The dissection should be continued far enough on the right side to permit the bone segment to be placed along the dorsum without resting on the flap.

The next step is to measure the distance from the root of the nose to the lobule to ascertain the length of bone needed to fill the space. The point at the root of the nose from which the measurement starts should

be definitely marked by sticking a straight needle into the structures, else it might be lost. Then a line is drawn from the needle up the forehead the same as the distance to the lobule. This marks the length of bone to be removed. The skin

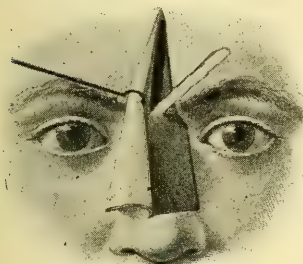


Fig. 876.
Author's Method, *a*.

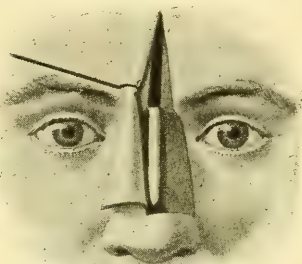


Fig. 876.
Author's Method, *b*.

incisions are made one inch longer, so as to have plenty of room to use the chisel. The sides of the wound are dissected for full one-half inch on each side, great care being exercised not to injure the periosteum. The chisel may now be applied in a very careful manner, so as not to which should be one-one-fourth inch thick, it approaches the root should end at the needle. at its base it can be point desired, i. e., at tion of the needle. By lower on one side than fracture is made accords ends of the fractured



Fig. 876.
Author's Method, *c*.

plied in a very careful fracture the bone strip, fourth inch wide and increasing in width as of the nose, where it By carefully lifting it made to break at the the place of the inser-carrying the chiselling on the other; if the ingly (obliquely), the parts will be in closer

apposition when the fragment is twisted and placed in its new position than if occurring in a transverse manner. (Fig. 876, *a* and *b*.) The bone is now carefully turned toward the nose, periosteal surface upward, and laid in close contact with the dorsum, the broken surfaces being held firmly against each other and the nasal flap being brought over and stitched in its place. (Fig. 876, *c*.) The edges of the wound of the forehead should be drawn together by sutures. The nose should have a light dressing of iodoform-gauze, bichloride gauze and a thin layer of absorbent cotton, over which a muslin nasal cap may be fitted to hold the dressing

in place. Unless there is much oozing or foul odor the wound should not be disturbed for from three to seven days, the longer the better if all progresses properly.

Medication.—The operation for rhinoplasty should always be preceded by a frank statement to the patient and friends that under the most favorable conditions in the hands of the highest skill success is not always a certainty. In cases where nothing better can be offered the patient an artificial nose of celluloid, or other material, held in place by rimmed spectacles, serves as a most complete and happy deception.

Aconite should always be the first remedy given unless another is specially indicated. It allays pain and irritability and controls arterial excitement better than opiates.

Ammonium carbonicum will often check the vomiting of chloroform when the ejecta are glairy or sometimes of a greenish hue—neither bitter nor sour.

Arnica will be called for if it has not been used in the preparatory treatment. Its action is to remove the effects of traumatism, and it should be administered when there are great pain and fever which arise solely as effects of injured tissues. The aconite fever comes on from nervous excitement.

Arsenicum is useful in those cases that remain in a depressed state after the operation, reaction not taking place promptly and fully. It is very well adapted to conditions following surgical operations upon aged people. There are restlessness, anxious expression on the face, cold skin, and there may or may not be a desire for cold drinks. Vomiting as soon as drinks are in the stomach, low temperature.

Belladonna has flushed face, throbbing of vessels of the neck and head, brilliancy of eyes, dilated pupils, pulse full and strong, restlessness but not from pain or anxiety; backache from anesthetic congestion of kidneys.

Bryonia has great pain, moving aggravating the suffering; patient forced to lie still; thirst for a whole glassful of water.

China is useful where there has been great loss of blood; pale appearance of mucous membranes generally; asthenic fever.

Ipecacuanha is one of the most valuable remedies for bilious vomiting after anesthesia. It frequently controls the vomiting in a few hours. Strong black coffee given in teaspoonful doses every hour or half hour is used at times when ipecacuanha fails. Hot water is also useful.

CHAPTER V.

HARE-LIP.

Definition.—This is a congenital cleft in the upper lip, single or double, simple or complicated. It is confined to the upper lip, and when the palate is involved presents a complication of such deformity with material impairment of function in speech, deglutition and food prehension. To the infant it is sometimes a matter of great embarrassment in the matter of nursing from the mother's breast. The defect is quite inclined to occur in connection with other congenital defects and deformities, as club-foot, nevus, strabismus, supernumerary fingers and toes. There is quite a proneness to multiply or repeat cases in the same family of children. Instances are given of the affliction attending the same family for several successive generations. The cause, as in other congenital bodily defects, is unknown. It would seem to consist in a simple arrest of development, but the why and the wherefore are matters sub judice at this time. The probabilities of occurrence are about equal as between the sexes. What influence the inter-marriage of near relatives and the refinements of luxurious life may have on the probabilities of occurrence might be matter for profitable consideration.

Operative Measures.—The matter of greatest practical consideration is the relief of this most unsightly malformation, which will be attempted only by an operation. The precise age at which this should be undertaken has been matter in controversy without settlement or conclusion. Probably it would be well in this case, as in many others, to be governed by a combination of circumstances and common sense. If the child at birth be puny and badly nourished, with little or no difficulty in nursing, the operation may be very properly delayed until six or twelve months of age. If, however, the infant be strong and robust, with such deformity as to make the process of nursing difficult, the repair may very properly be made at once, or within a week after birth. In the simpler forms of deformity the entire repair may be attempted at one sitting; but when double, with much deformity and loss of parts, the surgeon must be governed by circumstances as to whether two or even three successive operations may be required.

Surgical expertness and success in this class of cases will depend largely upon the ability to extemporize; for after reading all the cases in the books and while drawing upon experience the very next case will be unlike others and without precedent. The first step in the operation, after the suitable fixation and confinement of the child's hands and arms, which will be best accomplished by wrapping the child in a sheet, will be the separation of the lip from its subjacent attachments, which should be freely done in order that it may slide easily toward the other margin for coaptation. Better to dissect a little in excess than too little, or subsequent tension or pulling apart may interfere with union. The next step will be to pare the margins to be united. These margins present a

pink, pouting, exaggerated appearance much like the lip margin between the mucous surface inside and the skin externally.

The greatest care should be taken in obtaining a "good fit" at the lip margins. If these be so adjusted that one side is up and the other down an unseemly notch will result, much to the patient's disfigurement and the surgeon's disparagement. The third step is the suturing of the parts in apposition, in the detail of which there is some diversity among good practitioners. Gross, one of the world's greatest surgeons in ancient or modern times, preferred small steel needles with glass heads, of which he used from two to four, according to circumstances. If these or hare-lip pins are used they should enter about three lines outside of the cut margin and make egress at some distance from the margin on the opposite side. When in position about two-thirds of the lip thickness should be anterior to the needle. Each needle should have an elliptoid application of silk ligatures, say one-half dozen times for each needle. The elliptoid form is better than the figure of eight because flat and more equable in pressure. The points of the needles should be clipped off to prevent their entanglement with the clothing and the risk of hurt to the child's hands. Bits of wax on the needle-points will be a good substitute for clipping, as the needle will occasionally snap in the middle, instead of at the point, and so necessitate a reapplication. Should there be a disposition to pucker or stand open at any point between the needles a superficial stitch will complete the work. The parts should be left open so far as adhesive strips or envelope is concerned. The greatest precaution should be observed to prevent the child's floundering movements from interfering with the parts. It will be a safe precaution to keep the child's arms pinioned at the elbow for a few days so as to keep the hands from the face. The needles may be removed from the third to the fifth day, according to the progress of adhesion. The silk ligature which will now have become adherent from lymph effusion should be allowed to remain and fall off several days after removal of the needles, thereby serving as so many adhesive straps to strengthen and support adhesion of the new union.

Appearance.—The cicatricial appearance will not be altogether smooth and presentable at first, but will gradually lose its puckered, uneven surface, until, after six months, it will have greatly improved, presenting, indeed, a very satisfactory appearance. The process here described is applicable to a case of simple unilateral lip fissure. A case of double fissure presents many points of difference as well as difficulty. The fissures, instead of being straight and vertical, show a proneness to irregularity in line and a tendency to flare out obliquely toward the oral angle, involving much loss of structure. These double cases are very likely to involve integrity of the maxillary structure, and in bad cases the cleft may extend through both the hard and soft palate, hindering prehension and deglutition of food, entailing loss of voice and presenting a spectacle most hideous to behold. As a sort of factor in the unsightly make-up there will most likely be one or more knobs or islets of flesh and bone, presenting beneath the nasal septum and as a half-way post between the two fissures. The suitable management of these knobs or promontories will furnish ample opportunity for testing the skill and ingenuity of the operator. The question will at once present itself as to whether he shall

cut them off or attempt to patch and work around them. In most cases it will be found advisable in the end to snip off such as are fleshy, but the intermaxillary bone should always be preserved.

Repair.—In the matter of repair the same process of dissecting up the lips will be necessary as in the simple form, with the difference that the dissections laterally should be more extensive, so as to reach over the wider space. In some cases it will be necessary to make lateral perpendicular incisions external to the oral angle, in order to facilitate the sliding over of sufficient integument to bridge the chasm. In cases where the cleft involves the palate it must be left to the wisdom of the operator as to whether he attempt to make the entire repair at once or in different stages.

If the gap in the lip be closed first its gradual lateral pressure on the maxillæ tends to decrease the cleft in the hard palate. Of course the same paring and freshening of apposing margins will be called for as in operating on the lip, except that there must be the greatest possible economy in paring, as the parts do not slide from side to side with the same facility as in the case of the single fissured lip. Interrupted sutures of silver wire, silk, or silk-worm gut seem best adapted to the peculiar needs of this phase of the trouble. Whether they be carried straight through from left to right, or a halt be made at the mesial line, will depend altogether upon the presence or absence of landing or attachment points in the mesial space. The suture should dip well down into the tissue and should be one-fourth of an inch apart and be allowed to remain two to four days, according to the adhesive progress. Removal should begin with the upper or remote ones, the one at the lip margin remaining a day or two after the others. Immediately after the operation a light dressing (dry) of gauze protective and carbolated cotton will be in request.

Every precaution in favor of absolute quietude should be taken for the first two or three days; except under indications of hemorrhage or sloughing the dressing should remain three days before renewal. For the consolation of the family make known to them the promise that the uneven, unseemly cicatricial condition of the parts will find much amendment under the process of six or twelve months' time. The family should also be apprised of the fact that shock, severe inflammation, hemorrhage, gangrene, may work a fatal termination, but under the best surgical skill and precaution the percentage of such results is small.

NELATON'S OPERATION. —

This mode is quite available where there may be a slight notch at the lip margin, either from congenital defect or as the result of a previous operation which may not have been quite a success, as sometimes happens. The notch is circumscribed by an incision which does not involve the border



Fig. 877.

Nelaton's Operation for Single Hair-Lip.

of this lip. The piece so isolated is drawn downwards by forceps, leaving a diamond-shaped wound. The opposite sides of the wound are drawn together and united by suture. (Fig. 877.)

MALGAIGNE'S OPERATION. For a moderate degree of deformity this method is recommended as a special plan to avoid the labial notch. The edges of the cleft are freshened by detaching a flap on each side. Each flap is attached below, but free above, and meets at the upper angle of the cleft. These flaps are drawn down by delicate toothed forceps, care being taken to keep them out of the cleft. The upper part of the cleft is then united by sutures, while the projecting parts of the flaps are shortened to the extent required for a good fit, and are then drawn together by a few delicate sutures.



Fig. 878.
Malgaigne's Operation.

(Fig. 878.)

MIRAULT'S OPERATION. When the flap margins are asymmetrical and diverge much this mode gives good results. A flap is cut from the more vertical, or shorter one. It should be free above and attached below to or near the red borders of the lip. (A.) It should be cut by transfixing the lip just above its red border, and allowing the knife to emerge at the superior angle of the cleft. The flap must embrace the entire labial thickness, must be large and substantial and not a mere paring of the cleft's margin. The longer, more oblique margin is freshened, care being taken to make the fresh surface or margin as wide as may be. The flap is now drawn down and placed in position and the wound sutured.

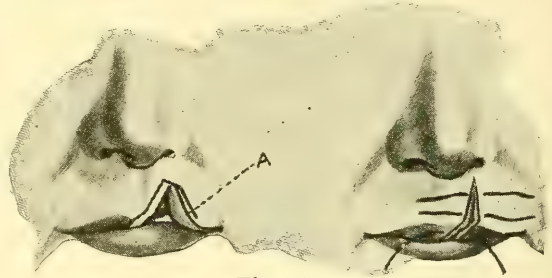


Fig. 879.
Mirault's Operation.

In attempting this operation it is of the first importance to observe a

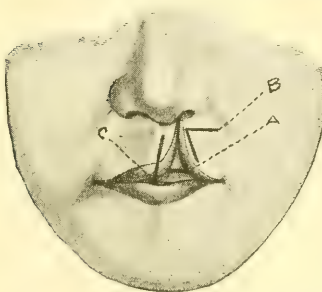
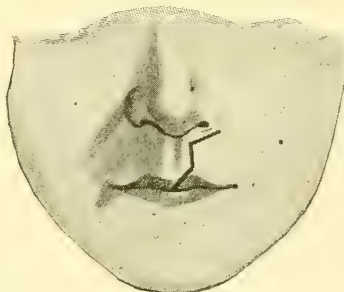


Fig. 880.
Giralde's Operation.



free separation of the lip from the maxilla; in some cases, to save tension, it may be necessary to go beneath the alæ. A frequent source of failure in this as in other modes of

operating consists in this want of freedom. (Fig. 879.)

GIRALDE'S OPERATION. This bears such strong resemblance to Mirault's as to make detail unnecessary in this place. Two flaps are made,

the one drawn up, the other down, and when sutured in place cover the vacancy. It is especially suited to cases where the fissure makes a break upon the nasal floor. (Fig. 880.)

ANOTHER METHOD. The method largely employed by the author, with very gratifying results and found available in most cases, is one that leaves no unsightly swelling, nor V-shaped notch to attract attention or mark the former existence of a congenital malformation. It is applicable

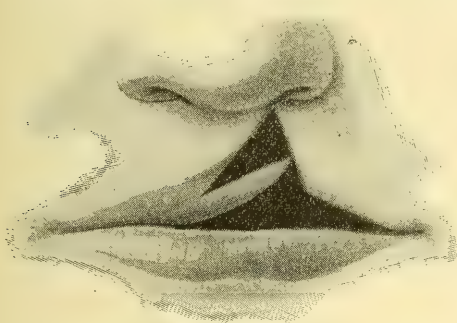


Fig. 881.
Author's Method.

to either single or double hare-lip in their uncomplicated forms, but cannot often be adopted where the clefts run through the alveolus.

In all cases of single hare-lip the borders of the cleft are of unequal size and length and thickness. The usual plan is to pare off the edges and then bring the raw surfaces together. By the method employed by the author the tissue of one side only is sacrificed, the other being made into

a flap, carried across the base of the gap, and fastened to the opposite side. (Fig. 881.)

The operation consists in freshening the smallest border with a sharp-pointed knife, beginning at the apex of the gap and carrying the incision to near the angle of the mouth, entirely removing the separated piece. Again entering the knife at the apex, an incision is made along the larger border of the lip to a point near the angle, not detaching the strip but leaving it as a flap to be used for closing the lower part of the gap after the sides are approximated and sutured. Great care should be exercised in all cases to freshen the extreme point of the apex. The lip should now be freely separated from the gum and every restraint to an easy joining of the flaps be removed. Sometimes it will be necessary before this end can be accomplished to freely separate the alæ from their bony connections. When an easy adjustment can be made the sides may be brought together and fastened with silk-worm gut, silk, or horse hair sutures, at the option of the operator, the author's choice being well prepared aseptic silk. (Fig. 882.)



Fig. 882.
Transverse Flap Stitched in Place.

The transverse flap can now be brought across the base of the gap and stitched to the opposite side. Should it be too long the end may be snipped off to suit the requirements of the case.

CHAPTER VI.

DOUBLE HARE-LIP—CLEFT PALATE.

General Considerations.—There is a difference of authority as to the means of coaptation to be employed, whether silver or steel pins or silver wire. Probably where there is a wide gap and much tension called for the pins should have preference. In milder cases silver wire, silk, or silk-worm gut may be trusted. In case of wide space Dewar, of Scotland, has proposed a sort of truss which makes strong lateral pressure on the cheeks by means of a spring band which compasses the back of the head.

Where there is a large gap, with much anterior projection and irregularity, Hainsley, Cooper, Malgaigne and Bonnet have tried, and in some cases successfully, strong systematic pressure as a means of depressing prominences and narrowing the gap as a preliminary to suturing. The same authorities rather discourage accessions of prominence as adding to the chances of unsightly cicatrices. Of course such pressure, to be serviceable, must be equable, systematic and persistent as to time. Several ingenious devices have been proposed, among which that of Hainsley has precedence as to usefulness.

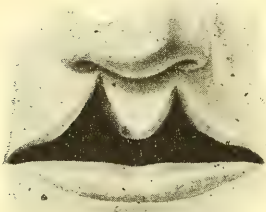


Fig. 883.
Flaps From Both Sides in
Uncomplicated Double
Hare-Lip.

In the case of an uncomplicated double hare-lip a flap is made on each side, and only the parings from the central body should be completely cut away. (Fig. 883.)

In all cases, whether single or double, the paring should be so made as to form decided angles, as in this manner a closer apposition of the parts can be made. (Figs. 884 and 885.)

Where the clefts involve the bony structures and are associated with more or less cleft in the

hard palate the lines of non-union are always between the maxillæ and the intermaxillary bone. The latter is a distinct osseous center in early fetal life, but becomes united with the maxillæ before birth when developed naturally. It contains the germs of all the upper incisor teeth, and for that reason it should never be removed during the operation to close the fissures in the lip, no matter how unnatural its position, nor how much of an obstruction it may be to the closure of the gaps. It was intended to fill the space between the maxillæ in front, and there it must be put. Its most frequent position of abnormal attachment is at the superior border of the vomer, lying close to the nasal lobule



Fig. 884.
Angles of Paring.

and filling the anterior nares. If the condition is not corrected before the period of teething the incisors will appear in an irregular manner, as shown in Fig. 886, some looking directly forward, others downward.



Fig. 885.
Parts in Apposition.

Cleft Palate Defined.—While treating of double hare-lip incidental allusion was made to cleft palate. A subject of so much import must receive systematic attention. This deformity has furnished brilliant examples of surgical success, while in unskillful hands or unsuitable cases miserable failures have occurred.

Operative procedure is mainly applicable to congenital defects, those from syphilis or malignant taint being unpromising. Cases not amenable to plastic operation sometimes receive much palliation and help at the hands of an ingenious dentist, by mechanical appliances. Syphilitic cases should not be attempted by plastic process until every precaution shall have been taken to eradicate the taint, and in no event for months after the last syphilitic manifestation. This precaution does not apply, of course, to loss from traumatic cause.

Cleft palate is usually in association with double hare-lip. The deformity may involve the soft parts only, or be so deeply seated as to involve both the hard and the soft parts, in which latter case function as to speech and deglutition may be seriously impaired. The bony loss may involve the posterior palatine arch only, or extend forward to the alveolar process of the maxilla.

The term *staphylorrhaphy* applies to the operation upon the soft part. *Uranoplasty* applies to operation upon the bony part.

To replace it bone nippers should be applied to the under surface, cutting upward till the bony attachment is severed, care being taken to go no farther. As much of the upper part of the attachment composed of gum and mucous membrane should be preserved as possible to give nutrition and material for union and growth in its new position. The lateral surfaces as well as the free ends of the maxillæ should be freshened; and when in apposition wire sutures are passed from the maxillary margin on each side to the intermaxillary body, to retain the latter in its proper place.



Fig. 886.
Showing Irregularity of Incisors.

Staphylorrhaphy.—Fig. 887. The operation on the soft parts was first attempted by LeMounier, a dentist, the cleft extending from the velum to the incisors. He first sutured the opposing margins and then freshened the margins between the sutures. Inflammation with suppuration followed, but resulted in a complete repair. It would seem singular that he reversed the usual order by suturing first and freshening afterwards.

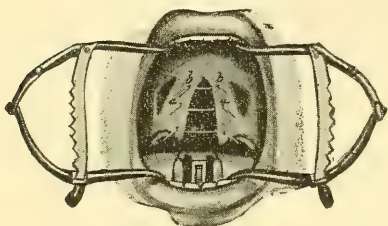


Fig. 887.
Staphylorrhaphy.

The operation as at present practiced was gradually evolved by Graefe, Roux, Dieffenbach and others in the nineteenth century; uranoplasty was attempted and established at a much later date. Metour and Warren, of Boston, took the initiative (1837) in uranoplasty, which

was quickly taken up and elaborated to a point of complete success by Langenbeck, of Europe.

To Avery, of Charing Cross Hospital, is said to belong the first successful operation in England on the bony cleft.

Much credit is due Smith, who first operated upon a young child under chloroform, and who has done so much to bring the operation to its present state of perfection.

The length and depth of the cleft will have much to do with the facilities or difficulties of the operation. If it be a short superficial cleft in the velum and soft palate the way to success and relief will be simple and sure, as freshened margins and a few sutures quickly do the work. But if the cleft extend forward, so as to pass through the alveolar process and go deep through palate and bony vault, the case will be very different. The state of the soft parts as to amplitude or paucity will much affect the operation. In some cases there will be found abundant available tissues easily adjusted to the wants of the case; in others there will be found a shrunken state of the parts not at all favorable to the convenience of the operator or the success of the operation. Not a little of the difficulty in operating will depend upon the size of the mouth. This fact, together with the danger from shock in infancy and childhood, makes an early operation undesirable. If, however, the child be healthy and strong, with only a slight deformity of soft parts, an operation may be an entire success in early childhood. Smith condemns an early operation as a general rule, and thinks it should not be attempted before the twelfth year of life.

ORDER OF OPERATION. In case of complete cleft it was at one time advised to close the cleft in the velum first and leave the anterior and hard part to be dealt with subsequently. Smith advises that the entire operation be done at once.

Treves says he has always followed this course, and that results have quite justified the practice.

Smith makes one exception: where the cleft is so wide as to require so large a flap that vitality might be endangered he advises that the easiest part of the operation be performed first, and the other subsequently, as the part first repaired will furnish vitality and nutrition to the second.

INSTRUMENTS. From seven to ten pieces at most will be found to meet the demands of the occasion, to wit: a cleft palate sharp-pointed knife, a cleft palate hook, long forceps, raspatory, Oliver's rugine, palate needle, suture catcher, Whitehead's mouth gag. These, with a suitable pair of curved scissors and suture material will be found to be quite enough for probable wants. If wire sutures are used then perforated shot and clamp or wire twisted should be added to the list.

POSITION OF PATIENT. The attitude of the patient should be such as to enable the operator to work without stooping. For this purpose the upper part of the body should be well raised and the head thrown decidedly back.

The table should be narrow, the surgeon standing on the right and the anesthetist on the left. One assistant stands at the foot of the table to assist the operator, while another at the other end fixes the patient's head and watches the gag, which sometimes so depresses the tongue as to dangerously embarrass respiration. The gag being in place and the patient suitably chloroformed, the first step will be to pare the edges of the cleft. An adroit use of the tenaculum holds the velum taut and so facilitates the use of the knife employed in the freshening process. The entire margin on each side should be pared freely, care being had that the tip of the uvula and the anterior angle of the cleft do not escape their share of the touch, which they are likely to do if not watched. The raw surface should be wide and uniform throughout.

Scissors should not be used in paring the margins.

The sutures should be introduced from below upward, the first being at the apex of the uvula, and left uncut so as to make the parts tense when drawn upon, it being desirable to wound and afflict the parts with the tenaculum or forceps as little as possible. When the second suture has been placed the surplus of the first should be cut and the second left long as a means of steadying the flaps, and so on in succession to the last one. The number of the sutures will depend upon the needs of each particular case and especially the degree of tension called for.

The sutures, whenever it is possible, should be passed by one transit of the needle from side to side of the two margins and tied in a gentle manner. Any pulling may tear them out. The finer ones near the base of the uvula may be introduced with a rectangular or curved needle.

Avery's Method.—This is as follows: A needle carrying a long suture is passed through the cleft at the palate from before backward. The loop is caught when the point of the needle is in the cleft and is drawn out of the mouth. The needle is then withdrawn, leaving the loop in situ. A long suture is in like manner passed through the other flap to the right side of the palate. It is in like manner drawn through the cleft and out of the mouth, not as a loop but as a single thread. The needle is withdrawn. The left half of the velum will therefore be pierced from before backward by a loop of suture, the right half by a single thread. The single suture is passed through the loop. The loop is withdrawn, dragging the single suture with it, when the suture will therefore have passed through the right half of the palate from before backward and through the left half from behind forward.

When there is too much tension to admit of the sutures being tied

at once they should all be passed and loosely twisted. The long ends may be cut off and longitudinal incisions may be made on each side parallel to the cleft and just internal to the hamular process, avoiding the immediate neighborhood of the posterior palatine foramen. It is well to make the incision with a blunt-ended knife, after puncturing the palate with a sharp-pointed knife. Sufficient relaxation being obtained, the remaining sutures should be quickly and permanently knotted.

If after the lateral incisions have been made the tension is not relieved it is well to introduce a slender-pointed raspatory through the incision, with it to detach the muscular and tendinous structures from the hamular process. The author has found such a step to always answer the purpose completely.

Throughout the entire operative process bleeding must be restrained by gentle pressure from a sponge in holder. The bleeding will rarely be excessive, however, and little attention need be given it except as it obstructs the view and respiration.

The sponge, moreover, should be used as infrequently and as gently as possible. Excessive and officious handling and dabbling among the parts serve to irritate the muscles into activity, increase a troublesome flow of saliva and provoke vomiting and coughing, all to the great hindrance and annoyance of the operator.

When shot are used to fasten the wires the sutures should be passed from left to right, the needle transfixing both sides of the divided uvula at one thrust. The end of the wire should be caught by a pair of forceps or small tenaculum, the wire freed from the slot in the needle and the latter withdrawn. Both ends of the wire are brought outside the mouth or carried through the perforation in the slot. The latter is gently slipped along the wire to the uvula until the gap is closed, when a clamp may be applied, the shot compressed and the wires cut close to the shot.

The needle most suitable in such cases is one with a curved point, having a slot on its edge which is opened and closed by a sliding bar extending to the handle. The utmost gentleness is required to steady the bifid uvula after the sutures are passed and the shot run up the wires, lest undue traction tear the stitches loose.

If no shot is used the wires should be twisted by forceps made for the purpose (Emmet's), or in lieu of these the ordinary blunt-pointed forceps with a sliding catch to fasten them firmly on the wire.

CHAPTER VII.

CLEFT OF HARD PALATE.

Langenbeck's Operation.—If there is sufficient material for closing the cleft the mucous edges of the abnormal margins may be pared. If there is any doubt about this the proceeding must be dispensed with as involving a waste of flap. To bring down the muco-periosteum from the bones a mere puncture should be made down to the bone with the scalpel, midway between the teeth and the margin of the cleft and opposite the middle of the cleft—i. e., midway between the anterior angle of the cleft and the posterior margin of the hard palate. Through this puncture the least curved of the raspatories should be thrust between the periosteum and the bone, and pushed outward and upward towards the middle line until its point appears in the cleft. At this spot one or more curved raspatories should be inserted, the instrument first used being withdrawn. The curved raspatory should now be used to separate the muco-periosteum from the bone, best accomplished by to and fro movements and careful traction. The periosteum is easily detached until the posterior margin of the hard palate is reached, where the soft palate is firmly attached by fascia and by its connection with the mucous membrane on the floor of the nose. Curved scissors should be used to divide this attachment, the palate being drawn forward with a hook to put it on the stretch while the scissors are passed behind it.

The scissors may now be used with closed blades as a raspatory to draw forward the soft parts at the junction of the hard and soft palate, and complete their separation from the bone. When the hard palate is cleft up to the incisor teeth there is often difficulty in completely separating the periosteum at the anterior angle of the fissure. Should this be the case, a small rectangular knife can be used to free the soft parts.

The muco-periosteum being completely separated from one side of the palate, the assistant should thrust a sponge into the cleft and press firmly against the bone. This will restrain all hemorrhage, give an opportunity for cleansing the fauces from blood, and allow of the re-administration of chloroform.

The soft parts being separated from the bone on the opposite side of the cleft in the same manner, silk sutures may be passed as in the soft palate operation, or if silver wire is used each suture should be twisted up as far as practicable without risk of breaking, and cut short, so as to leave about the sixth of an inch projecting. Tension should be relieved by prolonging the small incisions made for the introduction of the raspatory forward or backward, as the circumstances of the case may require.

The incisions should go quite through the palate and are best made with a probe-pointed knife. All slack sutures should now be twisted up with torsion forceps until the edges of the cleft are in exact apposition. In bringing together this part of the palate care should be taken to evert

the edges of the cleft with a small double hook in passing and twisting up the sutures; this secures the apposition of the raw margins of the flap, and is especially necessary when the edges of the cleft have not been pared.

Davies-Colley's Operation.—This operation is divided into four stages. It is useful where the cleft is narrow and a considerable part of the hard palate is left.

FIRST STAGE. In the first stage a triangular flap, consisting of the whole of the soft parts, should be cut from that side of the hard palate which is widest; or if, as usually happens, the septum of the nose is attached to the palatal process of the superior maxilla the flap should be taken from this side. The apex of this flap should reach nearly as far forward as the insertion of the incisor teeth. The base is about opposite the last molar. (Fig. 888.)

The outer border of the flap should begin just internally to the back part of the alveolar process, and should run forward parallel to the margin of that process. The inner side of the flap should run backward one-eighth of an inch externally to the margin of the cleft, and should terminate a short distance behind the posterior border of the palate. The base which is left attached will therefore extend from close to the inner border of the alveolus to the last molar teeth.

SECOND STAGE. The second stage comprises an incision down to the bone on the other side of the cleft, at least one-sixth of an inch externally to its margin. The greater part of the incision runs from before backward parallel to the cleft. It should begin at the level of the anterior extremity of the cleft, and should end at the back of the hard palate. At its anterior and posterior extremities this incision should be carried inward to the margin of the cleft. A raspatory is now inserted, and by it the muco-periosteum internal to the incision is separated from the bone as far inward as the margin of the cleft. This flap is turned directly across the gap so that the mucous surface looks toward the nasal cavity and raw surface in the mouth.

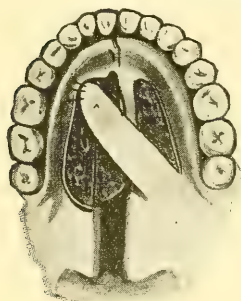


Fig. 889.
Davies-Colley's Operation.
Flaps in Position.

(so as to partly bridge across the cleft) by two moderately fine sheep-gut sutures passed through its edge and the strip of mucous membrane which was left on the in situ side of the cleft, internally to the triangular cleft. (Fig. 889.)

FOURTH STAGE. The apex of the triangular flap is now carried across the cleft, and the anterior part of its inner margin is attached by

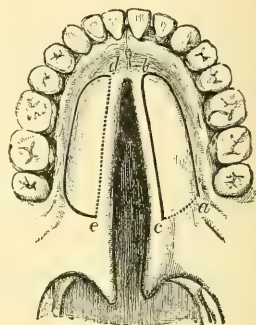


Fig. 888.
Davies-Colley's Operation for Cleft of the Hard Palate.
The Flaps (a b c and d e) marked out.

means of two or three silver sutures to the outer border of the incision upon the other side of the palate. If there is any difficulty in carrying the triangular flap across the cleft it may be necessary to detach its base more freely from the soft parts which connect it with the back of the hard palate. It will usually be found that the triangular flap lies very loosely in its new position, but no fear need be entertained that on this account it will fail to unite. The upward pressure of the tongue will constantly maintain the raw surface, which forms the upper portion of the flap, in close contact with the raw surface which, if the third stage has been properly carried out, is directed downward, so as to form a bed for its reception.

After-Treatment.—The patient should be kept under the greatest quietude, preferably in bed for one week at least after the operation. It were better that no effort be made in the way of food for twenty-four hours, other than a little acidulated water; and for the week the patient should partake only of such liquid diet as milk, gruel, light meat, broths and fruit jellies, such precautions being called for in order that efforts at mastication and deglutition may not interfere with the process of new union. Speech should be forbidden for at least one week, communications being made by slate and pencil. In most cases feeding by the rectum is the safest way to convey nourishment.

The mouth should be rinsed out after each taking of food with a dilute preparation of Listerine, boric or carbolic acid. The sutures may remain two or three weeks, according to progress in union. It is found that fine silver wire or worm-gut sutures produce very little irritation.

Adverse Results.—These may come from much vomiting, use of solid food, incidental acute epidemic prevalence, whooping-cough or feeble health of the patient.

The patient and family should be advised not to expect immediate complete vocal restoration. The probabilities will be little immediate improvement, but ultimately a gradual progress to a point of reasonable usefulness in vocal powers.

When the gap involves nearly the whole of the hard palate, with only a very narrow strip left on each side, apparently a part of the alveolar process, it is the author's custom to make an incision high up in the mucous membrane down to the bone, and then chisel off a portion of the alveolar along with what little is left of the hard palate. The line of division should be continued to the posterior border of the hard palate, and as far forward as the posterior surface of the alveolæ in front. The posterior extremity of the strip should be completely freed from its bony attachment, but the anterior end should remain attached for purposes of circulation and nutrition. The fragments are then forced as close together as possible, but not so close as to leave wide space between the fragments. Silver wire or worm-gut sutures are then carried through the gap on the left side into the nasal space, then across to the opposite side and down into the mouth through the gap on the right side. They should be secured by torsion and the ends pushed up into the median cleft.

It may require two or even three operations to make a complete success, each time lessening the width of the central gap.

CHAPTER VIII.

CHEILOPLASTY.

General Considerations.—This term has reference to surgical efforts for repair of loss of substance and disfigurements of the lips. The demand for surgical interference may be caused by traumatism, mercurial salivation, syphilis, epithelioma, or tuberculosis, etc. Fifty years ago, when a physician's professional standing was supposed to depend somewhat upon his reckless use of mercurial preparations in the treatment of disease, hideous losses and deformities were matters of every-day observation. Thanks to homeopathy and a general spirit of enlightened progress, this mode of therapeutic abuse, with all its devastating results, has come to be quite a rarity. Next to mercurial ruin syphilis formerly claimed the greater share of victims, but with improved modes in the use of mercurials it now takes precedence over all the other sources of this class of troubles. Cuticular tuberculosis (*lupus*), from its tendency to tissue destruction and great obstinacy, holds a prominent causative place in this class of cases. A marked difference between these cases and hair-lip is to be found in the fact that the latter is congenital and confined to the upper jaw, rarely in the lower jaw; the former are acquired and may appear in either jaw. The surgeon also finds an important difference in the matter of repair. Hare-lip under tolerably favorable surroundings promises well. The management of cicatricial surfaces and tissues where the plastic process is expected to play a part often requires rare skill and judgment.

In the presence of serious deformity, however, cautious efforts at repair may be attempted. This attempt would seem imperative at times, as when by the personal appearance of a young woman she may be driven out of society by the damage and disfigurement of her lips or face. Decision being in favor of an operation, the patient having been fully advised as to sources of failure, in the main the best mode will be that of Taliacotius in his rhinoplastic operation. The local environments and the health condition of the patient should be the best possible. The shape and extent of the flap will of course depend altogether upon the needs of the case. The cicatrized surface having been removed, the flap may be taken from adjoining parts or the forearm, at the option of the operator. The detail as to pedicle transference may be much the same as in the rhinoplastic process. Whether immobility shall be accomplished by suture, adhesive strip, or both, must be left to the election of the operator in each individual case. The dressing should not be changed under three days, and then in the gentlest manner possible. The diet should be liquid so as to involve the least possible labial motion. Rectal alimentation is preferable to oral feeding if the process disturbs the wound. Conversation should be absolutely prohibited. The process, if a success, will be fairly completed in ten days. At first appearances will not be at all satisfactory, but much beneficial change will

have been accomplished in six to twelve months. As a rule, aged and infirm persons should be advised against operations of the kind.

Jaesche's Operation.—For repair of the lower lip where there is considerable loss of substance and a large space to be filled. In the case of large median defect, symmetrical incisions starting from the angle are made on each side, and so curved as to meet at the lower border of the jaw. The flaps thus marked should be joined in the median line after having been freely separated from the parts beneath.



Fig. 890.

Restoration of Lower Lip.—Langenbeck—(After Lobker.)

longed on each side by incisions which pass along the remainder of the jaw around the oral angles and into the upper lip. The greater the defect the more nearly must the incisions approach the median segment of the upper lip, though this must not be quite approached for fear of injury to the coronary artery and artery of the septum. The flaps comprehended in the line of dissection are brought by their margins to the symphysis of the jaw and fastened by sutures. Sutures must be placed at the oral angles to preserve appearances. This method is suitable where the defect extends as far down as or below the movable part of the lip. Care must be taken not to invade the upper lip, so far as to make the mouth too small.

Estlander's Operation.—(Fig. 891).

This plan is employed where the labial loss is partial and on one side and where the defect extends on the skin below the chin. A triangular flap from the upper lip and cheek is fixed at and to include the coronary artery. The angle



Fig. 891.

Restoration of Lower Lip.—Estlander.—(After Lobker.)

is brought down and so placed that its acute angle falls on or into the angle of the defect, where it is fixed by sutures. The wound made in obtaining the flap should be closed at once by sutures, bringing the margins together.



Fig. 892.

Restoration of Lower Lip.—Brun's Operation.—(After Lobker.)

Brun's Method.—This method may be adopted where the entire breadth of the lower lip has been lost. (Fig. 892.)

Here two quadrilateral flaps are fashioned out of the entire thickness of cheek and upper lip, and are placed on each side of the defect. Being mobilized, they are so manipulated that the superior margins meet each other at the symphysis, to be united in the new position by sutures. A little dexterity will enable the operator to furnish mucous margin for the new lip from the material in hand. The wound in the cheeks should be closed by sutures.

Chin Flaps.—When the unsuitable quality of the skin on the lip and cheek makes it necessary a flap may be obtained from the chin. Flaps from this locality are very good, except for the lack of mucous tissues for the labial margin.



Fig. 893.

Restoration of Upper Lip.—Dieffenbach.

by the extemporizing ingenuity of the operator and according to the peculiar needs in each case, in some instances upon the plans above, reversing, of course, the direction of motion.

Partial Defects.—DIEFFENBACH'S OPERATION. This plan is suitable for central defect, with obtuse angle in the median line, under the nose, the flared edges being covered by mucous membrane. (Fig. 893.)

Two curved incisions start at the angle apex and pass around under the alæ. These incisions with the margins of the defect form the boundaries of two flaps, which are detached from their positions and brought together in the median line, the mucous parts being so manipulated and utilized as to provide mucous margin for the new lip. Appropriate sutures hold the margins in apposition.



Fig. 894.

Restoration of Angle of Mouth.—Serre.

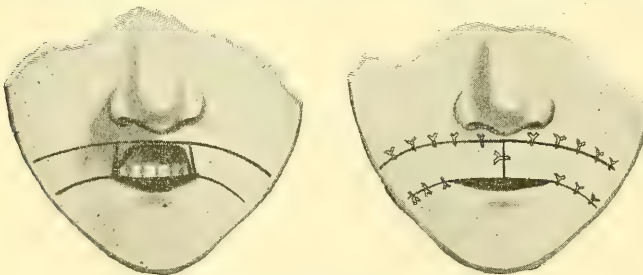


Fig. 895.

Restoration of Upper Lip.—Szymanowski.

triangles to meet by their bases at the defective angle. When the flaps have been suitably excised and shaped the edges are united by suture, a vertical and transverse incision resulting.

Repair of Oral Angle. — SERRE'S OPERATION. (Fig. 894, after Serre.)

The incisions are so made as to work two

Restoration of Entire Upper Lip.—SZYMANOWSKI'S METHOD. (Fig. 895). Lateral flaps of the full breadth of the lip are cut from each cheek; the outer extremities are curved downward, so as to relieve them from tension; when dissected up they are brought together and sutured in the median line.

SEDILLOT'S METHOD. An operation by vertical flaps when the entire lip is gone. Flaps of quadrilateral shape are made by means of the following incisions. An internal one starts from a point directly opposite the oral angle and extends to the lower eyelid, ending a little above the prominence of the chin. An inferior horizontal incision passes outward from the lower end of the internal incision for a distance of one and one-half inches. An external incision runs upward from the outer end of the last incision to a point on a level with the alæ of the nose. (Fig. 896). The two flaps comprise the entire thickness of the cheeks, and after being dissected up are displaced laterally and inwardly so as to cover the lost part, when they are sutured in the median line.

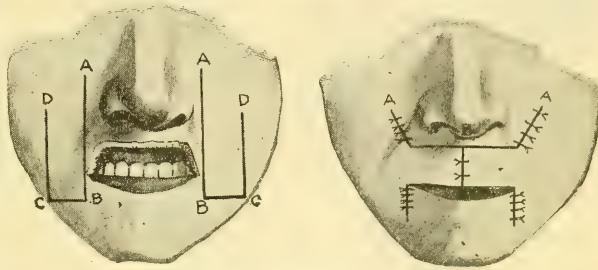


Fig. 896.
Restoration of Upper Lip.—Sedillot.

DIEFFENBACH'S METHOD. This is much the same with the exception that the loose or free ends are above instead of below. The flaps unite in the median line and are sutured in apposition (Fig. 897.)

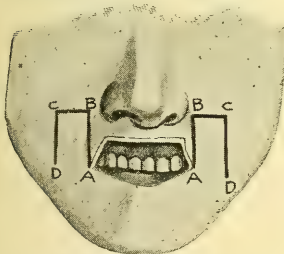


Fig. 897.
Restoration of Upper Lip.
—Dieffenbach.

BUCK'S OPERATION. This is for loss of one-half of upper lip extending to the nose and cheek.

This case as shown in the diagram is a hideous deformity (Fig. 898.)



Fig. 898.
Restoration of Upper Lip.
—Buck.

The lower lip is divided where it joins the cheek by a vertical incision at a right angle to the lip margin for one inch in length. Another cut of one and one-half inches begins at the lower end of the first cut and goes forward parallel with the lip margin. Then an oblique incision one and one-half inches long goes up from the second incision, nearly reaching the lip. As the flap attachment is at this point the cut must not approach too near the lip. The margins of the defect are freshened and the sound part of the upper lip freely detached from the bone. The flap from the lower lip is then twisted upward and its upper extremity held in apposition by sutures to the freshened margin of the defective lip. As usual, the gap made in obtaining the flap should be closed by suturing.

Contracted Oral Orifice.—BUCK'S OPERATION. A cut is made along the border of the lip extending an equal distance into both the lips,

passing near the defective angle. The cut should involve the skin only, not the mucous membrane. A pointed double-edged knife enters at the middle of the curved cut and is directed flatwise



Fig. 899.
Restoration of Angle of Mouth.
—Buck.

toward the cheek between the skin and the mucous membrane, so as to separate them from each other as far as the new angle of the mouth is to be extended.

The skin is next divided outward on a line with the commissure of the mouth (Fig. 899.)

The mucous membrane is now divided in the same line but not so far outward as the cut in the skin. The angles at the outer ends of the two incisions are accurately united by sutures. The freshly cut edges of the skin and mucous membrane, above and below, that are to form the new lip borders, are shaped by paring skin first, then mucous

membrane, in such manner that the latter shall overlap the former after they have been apposed by fine sutures.

CHAPTER IX.

CICATRICAL DEFORMITIES.

Definition.—This class of cases bears such close resemblance to those just mentioned as to leave little additional to be said.

Cicatrization is the final or concluding act of nature's effort to repair and replace parts lost by destructive processes. It invariably succeeds the adhesive or grandular forms of union. The cicatrix after the adhesive process will generally be found more satisfactory and presentable than that after the grandular process. The extent and depth of the injury will generally have much to do with the cicatricial process. Age and constitutional condition influence the results. The very young, the old and those in feeble health are not the most promising subjects. Broad, deep burns furnish cases for tardy progress and unsightly results. Long standing, deep and chronic ulcers do likewise. A recent cicatrix has a bluish, pinkish hue, is tender, "thin-skinned" and easily abraded. In cases under favorable circumstances all these peculiarities gradually subside and improve, until after six or twelve months a presentable appearance is attained. In exceptional cases a sheath of protection may be required indefinitely or in all after life, lest some unlucky touch may reproduce an "open sore." That a "cicatrix should rarely be touched with the knife" is now so generally accepted by the profession as to make the declaration axiomatic. Nevertheless, peculiar circumstances, and specially the importunate demands of a fair patient, may justify an occasional departure from the axiom. It has been proposed to correct deformities on exposed portions of the body by dissecting up the healthy integument on opposite sides of the scar in order to slide or stretch the healthy skin across the unsightly patch, the opposing edges to be held in apposition by sutures. With a healthy, robust subject and a small place for repair this mode is successful. And even in large places remarkable successes have been obtained, though these large areas require more undercutting. Another plan for improved appearance is to subject the part to gradual protracted tension or stretching whereby the wrinkles and seams smooth down and gradually disappear. As the plan is tedious, irksome, and not altogether promising its prospect for adoption is small.

Operative Measures.—Cicatrical deformities of the hands and feet are sometimes partially relieved by tenotomy to be followed by suitable instrumental corrections. In this class of cases it should be remembered that inflammatory processes have so agglutinated and bound down the tendons and muscles to the cellular surroundings as to discountenance the prospect of any considerable mobility. Deformities involving abnormal adhesion of apposing surfaces, as between the fingers, toes, and an arm and the chest wall, should be released by the use of a knife, being subsequently kept apart by the use of a suitable interposition of integument from adjoining surfaces until such time as granulation and cicatrization shall have completed their work.

Fig. 900 represents a case of cicatricial deformity the result of a burn. The cicatrix extended from the wrist to the axilla along the inner and somewhat on the anterior and posterior surface, and was dense and inelastic. Its greatest diameter transversely was five inches, and the smallest diameter four inches. The arm could be moved about five and one-half inches from the side and swung backward and forward for a distance of four inches. The whole mass from shoulder to wrist was dissected out and covered by a large flap taken from the back. The greatest diameter of the flap was twenty inches in a vertical direction by ten inches transversely. This was brought forward and stitched to the margins of the wound by interrupted silk sutures excepting where the flap folded back upon itself on the back of the arm, at which point the quilted suture was used, it being feared that the size and weight of the flap would tear the lateral stitches away. This expedient answered the purpose well, primary union was nearly complete, a few places of small dimensions sloughing and finally healing by granulation. In marking out the flap a piece of moist cloth was used, as it adheres to and keeps its place on the skin better than anything else. First obtaining the length of the diseased surface the cloth was laid upon the back, the posterior border being one inch from the spinal processes. The outlines were made one and one-half inches larger than the model at the upper and lower ends to allow for shrinkage. When the posterior boundaries were defined the posterior edge of the cloth was brought forward underneath the arm sufficiently far to cover the diseased area. Being held in this position, the anterior boundary points and lines were mapped out in order to show how far forward the dissections should be made. This accomplished, the morbid mass was rapidly removed and covered with a cloth saturated with a six per cent. saline solution, while an irrigating stream of the same solution was kept constantly flowing on the parts during the removal of the cicatrix. The flap was next quickly lifted up by sub-cutaneous dissection and transferred to its new bed. During this process two assistants kept the flap extended its full length and breadth so as to prevent it from shrinking, which it would have done inordinately if not so treated. Interrupted silk sutures were used to unite the margins of the flap with those of the arm, excepting where the flap was lifted upon the back of the arm, at which point the quilted suture was applied. Iodoform powder was dusted along the line of union until every suture and seam was buried from sight. Over this was placed iodoform-gauze, then bichloride gauze, protective and absorbent cotton, all being held in place by turns of the roller. The denuded surface on the back was treated similarly with the exception of the iodoform powder.



Fig. 900.
Cicatricial Deformity.



Fig. 901.
Showing Position
of Arm.

similarly with the exception of the iodoform powder.

The arm was bound to the side (Fig. 901) in an immovable manner by plaster of Paris bandages carried around the hand and body, and shoulder and body. The wound was examined on the second day, but not dressed, as it was found to be free from odor and discharge. The first dressing was on the fourth day when union was nearly complete, a few stitches here and there sloughing, these eventually healing by granulation. The sutures were removed on the seventh day and the flap severed from the body on the ninth day. Before applying the roller and plaster bandages a compress, two inches in thickness, was placed between the hand and hip to prevent the weight of the arm from falling upon the flap. (Fig. 902 shows how the flap is made.)

Aconite was given every hour for three days, and after that time bryonia was substituted and continued till full convalescence.

In the management of such cases too great care cannot be given to the preparation of the patient. Every bodily function should be in perfect working condition, especially the kidneys, skin and stomach.

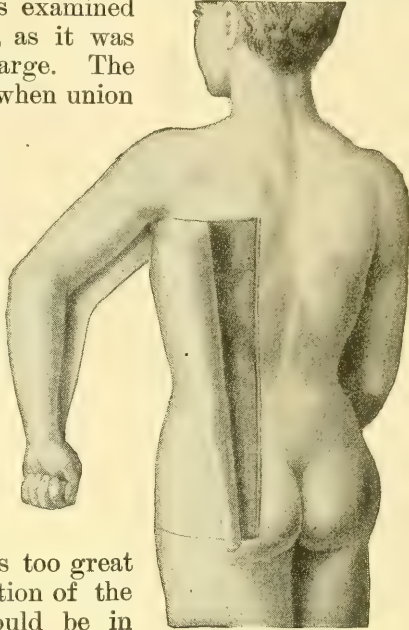


Fig. 902.
Showing how flap is made.

CHAPTER X.

WEBBED FINGERS AND TOES.

Definition.—This deformity, when congenital, is usually symmetrical. When the result of mismanagement after traumatism it will be irregular and asymmetrical, as after burns, ulcerations, etc., etc. Under the congenital variety the last two fingers will usually be the seat of trouble. It is likely to be associated with club-foot, hare-lip, cleft palate, strabismus, etc. The appearance of this defect among the first children of a large family presages one or several repetitions. The membrane may be thin and wide, so as to allow of considerable mobility of the fingers. In other instances it is thick and draws the fingers close together, so thick indeed as to be almost the thickness of the finger, allowing very little separate motion of the fingers. In severe cases the phalanges are so fused and drawn together as to render surgical attempts at separation inadvisable. About the sixth or eighth year is supposed to be the earliest age at which an operation should be attempted.

Treve's Operation.—The first step will be a perforation in the added web at or near the cessation of the normal web. Through this hole a silver wire as thick as a five to eight silver catheter is passed; with the ends bent back on the wrist and fastened there with a fillet or bandage. A solid India rubber cord of the same size may take the place of the wire, being similarly fastened on the wrist. The perforation inflames, suppurates and heals much as does the perforation in the pinna for an earring, the process being slow and protracted. Severe and troublesome inflammation has been known to occur, but may be avoided by means of rigid antisepsis. When the puncture in the web has healed the wire or cord is withdrawn, and a few days rest allowed the part before the web is divided from before backward to the perforation.



Fig. 903.
Webbed Fingers.—Zeller's
Operation.

The two fingers are kept well separated and wrapped during the healing process. This method, first introduced by Rudtorffer, who used a leaden thread instead of the silver wire or rubber cord, is said to answer well where the web is thin and broad.

Zeller's Operation.—A triangular or V-shaped piece is raised on the dorsal aspect of the web at its root, the base of which will correspond to the situation of the normal web, while its apex touches the first index-phalangeal joint. The flap embraces the entire abnormal web, and a small margin from the adjoining phalangeal dorsum (Fig. 903.)

The abnormal web is divided down to the natural one; the apex of the flap is drawn down between the fingers and sutured to a freshened place in the palm. The fingers must be kept well apart, especially to save the flap from undue pressure. A ring for each finger with an adjustable

bar reaching to each answers the purpose well. As there is a tendency at the tip of the flap to slough it must be made long enough to meet the loss. Dieffenbach made the flap quadrilateral to avoid this probable accident.

Two triangular flaps have been proposed, one from the dorsum, the other from the palmar aspect of the web, the dorsal one being a little the longer of the two. This mode fell into disuse for a time but has recently been revived in Great Britain.

Treves makes favorable mention of Zeller's operation, which he tried very successfully in a case with wide, thin, abnormal web, the fingers, of course, not being pressed very closely together.

Diday's Operation.—Two quadrilateral flaps, one from the dorsum of one finger, and one from the palmar aspect of the other, are carefully freshened out. Their length will correspond to the length of the web, and their breadth to the width of the raw surface they are designed to cover. Each flap will be a little wider at its proximal than at its distal end (Fig. 904.)

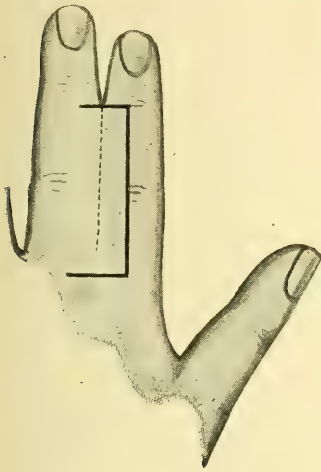


Fig. 904.
Diday's Operation for Webbed
Fingers.

the dorsum of the first named finger. The flaps are fixed in position by fine sutures.

This operation has been proposed for cases where neither of the foregoing seems applicable. The procedure is difficult and requires infinite care in its performance. The source of difficulty and possible failure is the risk that the flaps will prove too narrow at their proximal extremity (Fig. 905.)

Toes are not so frequently webbed, and when so found the inducements to attempt repair are scarcely equal to the pain and trouble. Indeed, the authorities mainly ignore the subject entirely. Supernumerary toes are seen, and when troublesome simply require amputation. Gross says if they are not closely amputated they show a disposition to reproduce themselves, minus any osseous element. Should any deviate from the natural right line relief may be sought in tenotomy and splints, as in club-foot and other deformities.

The free edge of each flap will extend up the median line of the finger at its distal end, but will extend beyond that line at the proximal end. The two flaps are dissected up. They must not be too thin. If, on the other hand, they are too thick they will be difficult to adjust.

When they have been well separated the remaining tissue which unites the finger is divided. The dorsal flap from one finger covers the raw surface on the palmar aspect of the other, while the palmar flap taken from this latter finger covers the raw surface left on

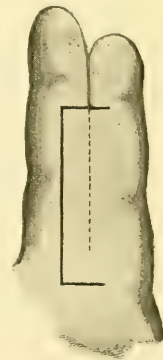


Fig. 905.
Webbed Fingers
—Diday.

SECTION XXX. AMPUTATIONS.

CHAPTER I. GENERAL CLASSIFICATION.

Definition.—By amputation is meant the removal by artificial means of a portion of the body. The term is commonly used, however, in a narrower sense, when it is understood to refer to a partial or complete severance of an extremity. A limb may be severed in its continuity or contiguity; in the former it is known as amputation or ablation, in the latter as dis- or ex-articulation.

Conditions Requiring Amputation.—**EXIGENCY AMPUTATIONS.** When a limb is torn off by machinery, cannon ball or when it is crushed off by cars or other means, the only question is how to secure a sound and useful stump, for which an amputation higher up the limb is usually necessary.

COMPOUND MULTIPLE FRACTURES. When the fragments are so numerous or so small and splintered that their adjustment and fixation are impracticable, especially if complicated by much laceration or contusion of soft parts and interference with the blood supply, amputation is demanded.

COMPOUND LUXATIONS. When the ligaments are greatly torn and the soft parts lacerated these frequently require amputation.

LACERATED AND CONTUSED WOUNDS. When the loss of tissue is extensive, the blood supply greatly interfered with or destroyed, even though the bones are uninjured, amputation is necessary.

GANGRENE. When attacking more than superficial structures this condition demands amputation. The rule to wait for a line of separation to form is the best, except that in local gangrene the result of injury, such as compound fracture, etc., the amputation should be performed as soon as mortification has manifested itself, for such patients usually die before there is time for a line of demarkation or separation to be established. In the spreading variety immediate operation is demanded, and at a point well above the process, usually above the next joint. In gangrene when the main source of blood supply is cut off by gun-shot or stab wound it is unwise to wait. In dry gangrene of old people it is doubtful if amputation should ever be performed—certainly not if the heart is feeble and diseased and the vessels arteriomatous, the exception being when the general condition is good and the atheroma is localized at or near seat of gangrene.

Hospital gangrene requires amputation occasionally when hemorrhage is profuse from some large vessel or after the disease is stayed, on account of extensive destruction of tissues.

EVILS OF EXPOSURE TO COLD OR HEAT. After frost-bite it is best to wait until the line of separation has been established; in burns or scalds, after sloughs have come away and the reparative powers of nature are fully tested and found to be too feeble, amputation is justifiable.

DISEASES OF BONES OR JOINTS. In these conditions when the more conservative methods, such as resection, have failed, amputation is required.

MORBID GROWTHS. Malignant growths involving bones or a large joint of a limb, and also non-malignant growths which from their location render the limb practically useless, necessitate amputation.

DEFORMITIES, CONGENITAL OR ACQUIRED. When it will remove unsightly deformities, or enable the patient the more readily to procure a livelihood, amputation is justifiable.

Complications After Amputation.—**MUSCULAR SPASM.** Muscular spasm which occasions intense suffering, lasting from a few hours to days, which greatly increases the irritability of the patient and the wound, can be best prevented by fixation of the muscles by an evenly applied bandage over a suitable support or splint. If this fails temporary use of an anodyne is demanded.

SKIN AND MUSCULAR CONTRACTION. Undue contraction of either skin or muscular flaps, rendering the tissues over the end of the bone too tense, causing either ulceration in the cicatrix or a conical stump, may necessitate a re-amputation.

SLOUGHING OF FLAPS. This is due to too tight application of bandages or sutures which interfere with the blood supply to the flap, or too sharp binding of the flap over the end of the bone, the tension and pressure interfering with the vascular supply.

SEPTIC INFECTION. This is one of the most common complications and most frequent causes of death, and should be guarded against by the most rigid asepsis at the time of operation and at subsequent dressings.

ERYSIPELAS. Fortunately this is an infrequent complication under modern surgery, requiring prompt attention when it occurs.

PAINFUL STUMP. This is caused either by an inflammatory condition of the nerves or by periostitis or osteitis at or near the end of bone.

Causes of Death.—**SHOCK.** Shock is the most frequent of all causes of death. When the injury has produced a great shock the amputation should be delayed until reaction has been established, unless a large vessel which cannot be controlled continues to bleed. Primary amputation is by far the most successful, yet, to be primary, the operation need not be so immediate as to prevent waiting for partial reaction from shock.

The larger the limb and the nearer to the trunk the seat of amputation, the greater will be the resulting shock and the higher the rate of mortality.

SEPTIC INFECTION. Sepsis is next in frequency as to fatality, hence the necessity of securing, when at all possible, not only clean but healthy tissue for flaps, the sacrificing of a little more of the bone and limb being of minor consequence to the securing of ample and healthy flaps, espe-

cially in amputation for diseased limbs. In amputation for recent injury, in a strong, healthy subject greater liberty can be taken in the attempt to save more of the limb.

CONSTITUTIONAL DISEASE. Previously existing visceral disease, especially acute nephritis, diabetes, or tubercular affections of the bronchi or lungs, or acute inflammatory conditions of either lungs or heart are frequent causes of death after amputation.

AGE. The young, before five years, and the old, after sixty-five years, very frequently die after amputation. This is due to shock occurring at a period of life when the system is least able to withstand its effects, and also to the diseases peculiar to these periods of life. In the young the power of resistance is undeveloped, in the old organic lesions and feebleness from exhausted functional activity being larger factors.

HABITS. While depraved habits of all kinds add to the gravity of all surgical operations alcoholics are especially prone to succumb after an amputation.

CHAPTER II. METHODS.

Division of the Soft Parts.—Ablation or ex-articulation is best considered in two stages: First, as to the section of the soft structures. For this a medium sized scalpel may be used to outline the incision, and if the flap method is employed it also serves to dissect up the integument. In addition to the scalpel it is essential to have a long and strong knife with a firm handle, an amputation knife. (Fig. 906.) To make the complete division this should be firmly grasped in the hand and a long, bold incision be made, after the manner to be described when considering the different methods.

Care should be taken to make the division as evenly as possible in order not to give rise to the “dead spaces” which are so favorable to the development of sepsis. In amputations as in all other operations it is advisable, for various reasons, to make use of as few instruments as possible, hence many operators prefer using only one knife—which is all that is required—little practice being necessary to become skillful in manipulating a long knife. All the structures being divided down to the bone, the periosteum is to be forced back sufficiently far to form a covering for the bone after its division—a procedure which is of itself of special technique. For dividing the inter-osseous tissue, as in the leg or fore-arm, there will be required a long, narrow, double-edged knife (Fig. 907), though a narrow bistoury will suffice. Having severed all structures down to the bone, the catlin is passed through the inter-osseous space in such a manner as to describe a figure-of-eight, thus dividing the remaining tissue, the soft parts being carefully protected by means of a retractor. This is made by splitting a compress half through its centre, or where there are two bones to be divided by making three “tails.” This is to be applied over the flaps, and retracted to avoid injury from the saw and prevent the bone dust from being scattered over the wound surface.

Division of Bones.—Having both ends of the limb well supported, the bone is divided by means of a saw, which should at first be drawn backwards across the bone, when a sufficient groove will be made to prevent slipping and unnecessary interruption. The bone

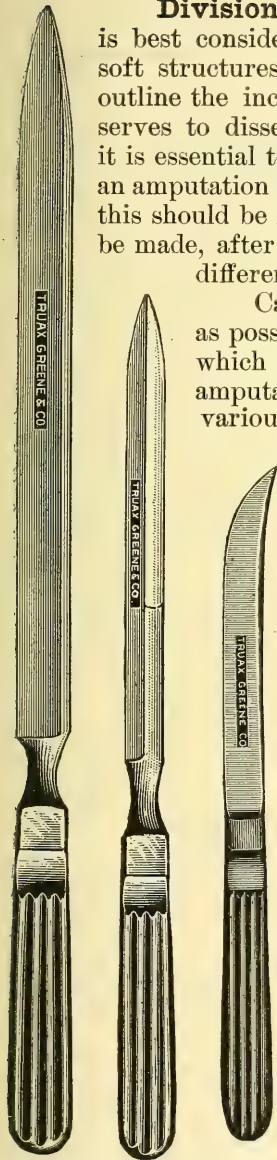


Fig. 906. Fig. 907. Fig. 908.
Catlin. Double edged Knife. Knoll's Knife.

should be steadily and not too rapidly divided, otherwise the heat produced by the friction may be so great as to cause subsequent necrosis. For this reason it is also well to have the parts irrigated during the process of bone division. Especial care must be taken as the incision nears completion, otherwise there is danger of snapping and splintering the bone. Where there are two bones it is well to divide them simultaneously,

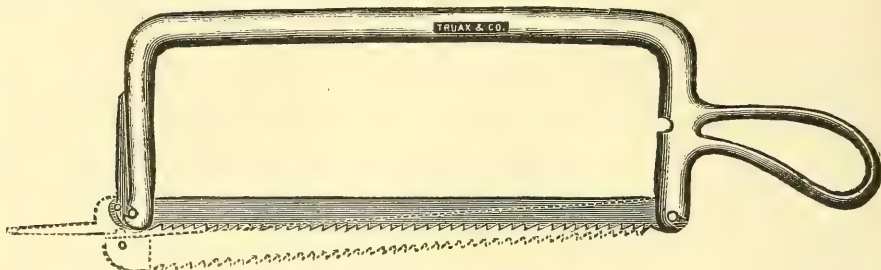


Fig. 909. Bone Saw.

or as nearly so as possible—being careful to complete the division of the smaller one first. The surgeon can make use of the ordinary or butcher's saw, as he prefers, the latter possessing the advantage of a narrow blade and therefore producing less friction than the solid blade saw, while if well made it is sufficiently firm to divide the largest bone.

The bone, having been divided, should be carefully examined for any sharp points of prominence, which should at once be removed by means of the bone forcep, otherwise they may injure the soft structures.

Disarticulation.—The second stage of this procedure consists in opening the joint. This is, as a rule, easily accomplished if the anatomy of the joint is borne in mind—as certain integumentary folds and osseous prominences give the topography very accurately.

The principal object to be obtained in an amputation or disarticulation is a sufficient covering to the end or stump of the divided extremity.

This is accomplished by following one of two methods, known respectively as the circular and flap operations, all other methods being simply combinations or modifications of these two. In the forma-

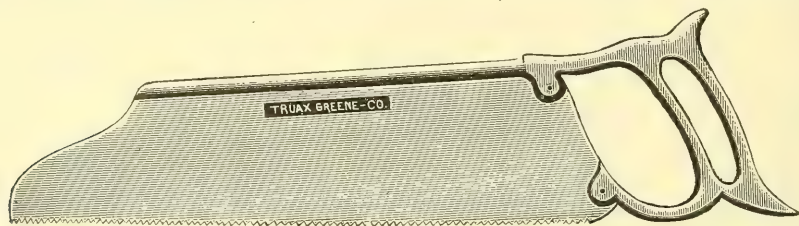


Fig. 910.—Amputation Saw.

tion of a covering for the divided part it must always be borne in mind to have the flaps of sufficient length—allowing for shrinkage, both immediate and subsequent. A good rule to follow is to make the flaps about a third longer than a radius of the circle equal to the circumference of the limb at the point of division.

Circular Method.—This can be done in two ways: First, by simply drawing the knife around the circumference of the limb, dividing

the integument, fascia and muscles at a right angle to the long axis of the limb. The soft structure being now retracted the bone is sawed through at a plane as far above the arc of incision in the soft parts as possible. This method is applicable only where the limb is cylindrical, e. g., the arm, and has the advantage of rapidity of execution.

The circular method (Fig. 940) in two stages possesses the advantage of being applicable to almost any part, is of rapid execution and affords a good covering to the stump. It is performed in the following manner:

The knife is made to circumscribe the limb, as in the above method, dividing, however, the skin and fascia alone, which is retracted sufficiently to form a flap or cuff, when the remaining soft structures are cut through at the highest plane of the retracted skin; these in turn are again retracted and the bone is divided, completing the amputation.

In the muscular portions of the extremities the circular method may be done in three stages as suggested by Desault: First, the division of the skin, this to be followed by the division of the upper layer of muscles, and finally the deeper layer being cut through, exposing the bone, which in turn is sawed through.

The circular method in two stages is by far the more preferable of this variety of amputation.

In carrying out this method the knife can be made to circumscribe the limb in one turn, or where the part is large, as the upper thigh, the division can be made by describing two semicircles which meet.



Fig. 911.
Bone Forcep.

Encircling by one sweep of the knife is done in the following manner: The operator stands upon the right side of the limb, his left hand is made to fix the point of dissection, the left foot is put forward, the knee is bent slightly and the right foot is extended backward sufficient to give freedom of motion to the body. The knife is taken in the right hand between the thumb and fingers and is made to encircle the limb by passing it around from beneath until its back presents to the operator's face, with its point dropped well downward. The blade being now firmly pressed against the skin,

the knife is firmly swept round the limb, the operator gradually rising from his stooping posture until the circle is complete. The skin is now reflected, aided by a few slight strokes of the knife. Here it is necessary to direct the cuts toward the limb in order not to interfere with the nourishment of the flaps. Where the limb is very conical it frequently becomes necessary to make a longitudinal incision in the cuff in order to admit of its reflection. The cuff having been made, the remaining structures are divided as before, by a circular sweep of the knife, down to the bone.

Flap Method.—(Fig. 940). By this method the stump is covered by one or more flaps, consisting of all the soft structures or of skin and fascia alone. The former is made by passing the knife through the limb close to the bone, and cutting from within out, known as transfixion. In the latter variety the skin, having been mapped out, is dissected up to a sufficient

length to cover the stump, the remaining structures being either divided by transfixion or by the circular method. Thus it will be seen that these methods can at times be advantageously combined.

The rectangular flap method of Teal is but a modification of the above and its application is limited.—(See Special Amputations.)

Simultaneous Amputations.—In cases of severe railroad accidents in which more than one limb must be amputated the question of simultaneous or consecutive amputations is presented. There is no question

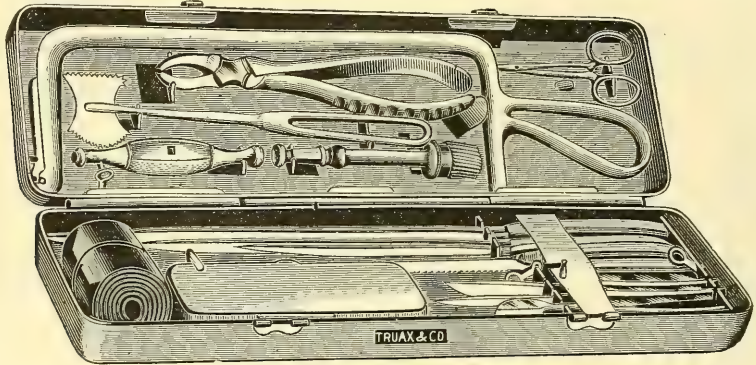


Fig. 912.

Aseptic Amputating and Trepanning Case.

in the author's mind that it is best to wait until reaction from shock has commenced and then the most expeditious method possible is the best, the time of operation causing more shock than its magnitude.

When it is possible to have two or more surgeons each should select a limb and proceed to operate at the same time. Failing in this the limb most injured should be removed first, and while an assistant is taking up the vessels and dressing the stump the surgeon should proceed with other needed amputations, known as consecutive amputations.

In order to perform an amputation without interruption it is well, as in all other operations, to have the proper number of assistants, with an orderly arrangement of the instruments as well as a specific duty for each assistant in the operation. For the performance of a larger operation it is necessary to have at least two assistants beside the anesthetist, the duty of one being to support the extremity which is to be removed while the other is occupied in attending to the instruments. These are essential and when possible it will be found very convenient to have an additional one to assist in the operation.

The instruments required for an amputation are a scalpel, amputation knife, catlin, saw, one dozen hemostatic forceps, bone pliers, tissue-forceps, scissors, curved and flat, Esmarch bandages, ligatures, sewing material, drains.

CHAPTER III.

GENERAL TREATMENT.

Prevention and Control of Hemorrhage.—The prevention of hemorrhage may be accomplished by a general compression of the limb in its entirety, as by a tourniquet, thus completely shutting off the circulation to the part, or by controlling the circulation through the main artery alone, as by some of the specially devised forms of tourniquet, or by digital compression.

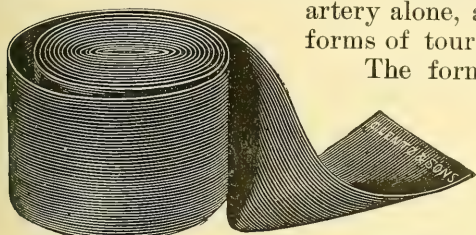


Fig. 913. Esmarch's Tourniquet—Three Yards Bandage.

The former of these methods consists in placing a constricting band or tourniquet between the heart and the part to be divided; for instance, if the lower extremity is to be severed above the knee the constricting band is placed at the upper portion of the thigh.

By placing a tourniquet around a limb, the circulation being entirely suspended, the blood contained in the limb distal to the point of constriction is necessarily sacrificed. This loss of blood may prove very serious, especially in cases of anemia, and Esmarch devised a method to overcome this difficulty, which consists in applying an elastic bandage from the extremity of the limb up to the point where constriction is to be made, thus producing an ischemia of the entire limb below the point of constriction. This method has, however, been superseded by simply elevating the limb and allowing the blood to return to the body by gravitation, aided by gentle strokes of the hand, this being sufficient to empty the superficial vessels, as it has been found that by employing the Esmarch bandage, not only the blood but all septic or other material contained in the limb is, of course, also driven into the healthy tissue, and this, for obvious reasons, often proves of great disadvantage.

This to-day is the generally accepted method of prevention of hemorrhage.

Digital compression is, however, at times still employed, and can be made either by compressing the main artery of a limb against some osseous prominence, as, for example, compression of the axillary artery against the head of the humerus, or the main artery of a limb can be compressed in the flap before it is completely severed.

A method that has largely been employed in the past is that of ligation of the main artery in its continuity just previous to the performance

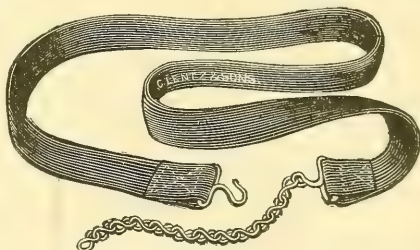


Fig. 914. Esmarch's Tourniquet—Rubber Strap and Safety Chain.

of an amputation. This method was previously employed in ex-articulations at the hip and shoulder prior to the introduction of Wyeth's and Keen's methods, which are described under Special Amputations.

As either of the above methods so materially affects the circulation of the part that if continued beyond a definite period of time gangrene would necessarily supervene, we are obliged to have resource to other methods permanently controlling hemorrhage. This is accomplished, as in all other bloody operations, by carefully isolating the ends of the divided vessels and grasping them with hemostatic forceps, after which they are permanently secured by means of ligatures, preferably of sheep-gut, as these produce the least irritation and are absorbable. In vessels of large calibre, however, it may at times be advisable to substitute silk ligatures. The smaller vessels can, as a rule, be obliterated by means of torsion, though it is always safer practice to tie all vessels. This assertion is made while fully cognizant of the fact that some surgeons are content with applying torsion to all vessels; but unless the surgeon is within immediate call the author has no hesitancy in advising against such practice. The application of a ligature takes but little if any longer time and certainly assures greater peace of mind to the surgeon, should it do no more.

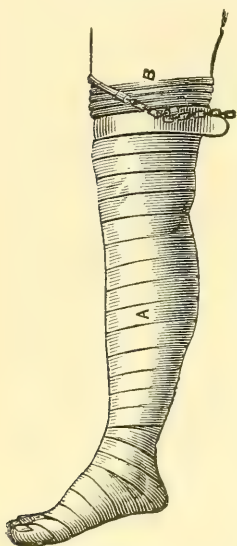


Fig. 915.
Esmarch's Tourniquet
Complete.

The principal artery should be ligated first. This being accomplished, the tourniquet is gradually removed, as it may happen that one or more vessels of good size have so retracted as to escape detection and necessitate the reapplication of the constriction. All the vessels having been taken up with hemostatic forceps, the constriction is best removed, as unnecessarily prolonged anemia may interfere with the healing process. In applying the ligatures it is well to carefully isolate each vessel. The capillary hemorrhage from the soft structures and bone is, as a rule, readily controlled by the application of hot compresses. It is an important point to carefully check all bleeding, as the subsequent healing process greatly depends upon a complete hemostasis.

Treatment and Dressing of the Stump.—The limb having been severed and all bleeding arrested, the question of how to treat the stump follows. This may be done in one of several ways, greatly depending upon the condition of the stump, each instance being a law unto itself and the judgment of the surgeon deciding which method is to be practiced. In brief, it may be said that an amputation-wound is governed by the principles which hold good in the treatment of all wounds. Where the tissues are perfectly clean (surgically) the wound can be united by several rows of sutures, either continuous or interrupted, otherwise the wound may be approximated, allowing for drainage; or where there is any doubt as to its septic con-

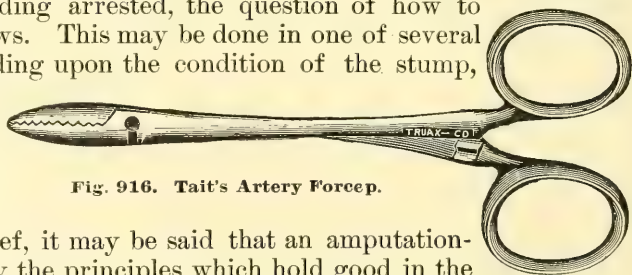


Fig. 916. Tait's Artery Forcep.

dition or if there is a persistent oozing the entire wound can be packed with a gauze dressing and subsequently united by secondary sutures. This latter has proven highly satisfactory to the author in those cases of "railroad crush" demanding immediate amputation.

After the wound is closed as above there should be applied a liberal dressing of sterilized gauze, wool, or cotton or other similar material.

This may contain carbolic acid, bichloride of mercury, iodoform, boracic acid or other antiseptic as the surgeon prefers. This is to be covered with some non-absorbing material or protective over which is to be applied a band-

age, after which a tin, felt or paste-board splint is adjusted and retained in place by bandage and

Fig. 917. Spencer-Wells Artery Forcep.

the limb placed in an elevated position. As the materials used for these dressings by different surgeons are so variable a more specific distinction is not considered neces-

sary here. The author's rule is when the wound is entirely closed to first apply a piece of gum protective properly prepared immediately over the line of incision. If drainage is necessary then a powder of iodoform, or one part boracic acid and nine parts of aristol, is applied to the line of incision, then iodoform-gauze, followed by sterilized gauze and cotton, is applied as indicated above.

After-Treatment.—The after-treatment consists in absolute rest of the patient as well as the stump. The stump is to be kept free from all pressure of bed-clothes and be kept elevated. The diet should be liquid and every attention given to secure mental and physical rest. The rules governing wounds as to time of re-dressing and absolute asepsis at every re-dressing are to be rigidly enforced.

Medication.—Aconite will often be found useful for the inflammatory symptoms following amputations and for the pain and tension which so often follow. The limb is hot, swollen, painful, and the patient shows elevation of temperature and other constitutional disturbances.

Arsenicum is a useful remedy if the stump shows unhealthiness, with ichorous discharge, edema, foul-smelling secretions, the patient experiencing rigors, sweats and prostration. Colliquative diarrhea from shock or sepsis will be met by arsenicum.

Lachesis may be required if the septic state is profound, especially if gangrene threatens. The wound is dark, foul and unhealthy. The prostration of arsenicum is lacking but, withal, pronounced debility is present. The patient wakens from sleep, which has been fitful, startled and delirious. For the so-called "surgical typhoid" lachesis is especially indicated.

Carbo vegetabilis is also a useful remedy in gangrenous states following amputation or injury. The patient is collapsed, the wound dark,

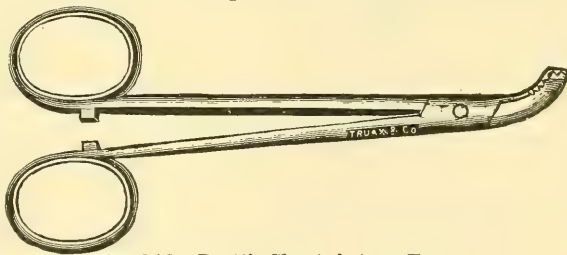


Fig. 918. Pratt's Short Artery Forcep.

even blackish, the odor intolerable. Blebs form about the edges of the wound.

Ferrum phosphoricum is very like aconite in relation to inflammatory conditions. The stump is swollen and painful, red, even dark red, and the patient has headache, thirst and passive delirium.

Camphora, veratrum album, arsenicum, carbo vegetabilis and strychnia may be demanded for shock following amputation.

Chamomilla will often allay post-operative pain in hyperesthetic subjects, being especially useful in the young. The reactionary pain following shock may also call for it.

Staphisagria will relieve the sharp pain following the operation.

Arnica is indicated in intense soreness of wound, bruised feeling all over; patient restless or semi-stupid.

Belladonna is demanded when face is red and hot; hot feeling all over; thirst; throbbing headache; dryness of throat; hurried, anxious breathing, or stertorous breathing; jerking or spasmodic pains; restlessness; delirium, etc.

Bryonia has great heat or chilliness with heat of face; lips dry; thirst, tongue dry; stitching pains in chest or limbs; restlessness, tossing about; tense, swollen condition of wound without much redness; sense of general debility.

Rhus tox.; great heat and anguish; muttering delirium; picking at imaginary objects; tongue red, dry and rough; wound dry, red or dark color, swollen and painful.

CHAPTER IV.

SPECIAL AMPUTATIONS.—FINGERS.

Applicability.—All men are, to some extent, dependent upon their fingers for a living; hence, when these are injured or diseased the surgeon must be careful to preserve as much useful tissue as possible. Even a rudimentary stump may serve to grasp a pen or pencil. The rule as formulated by Wyeth is that “it is rarely, if ever, justifiable to do a primary amputation of fingers.” The tissues are quite vascular and on

this account often recover from the effects of even serious accidents. The palmar surface is the more vascular, more sensitive and more accustomed to pressure, so that, whatever method of amputation be employed, the palmar flap is always the most efficient covering for the end of the stump.

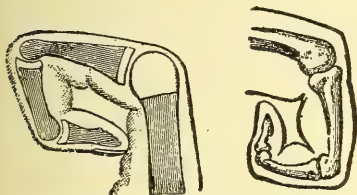


Fig. 919.

Fig. 920.

Fingers Flexed to Show the Joint Lines and the Epiphyses.

Among the more important anatomical points is the fact that when the finger is flexed at any joint the prominence on the dorsum is made by the end of the proximal bone. Next, that the creases on the palmar surface bear the following relation to the

joints, viz.: The creases at the base of the distal phalanges are above the joint; those in the middle of the fingers are about opposite the corresponding joint, while the metacarpo-phalangeal joint is about three-

quarters of an inch above the creases at the base of the fingers. No flexor tendons are inserted in the proximal phalanx, a fact which will sometimes lead to the preference of oper-

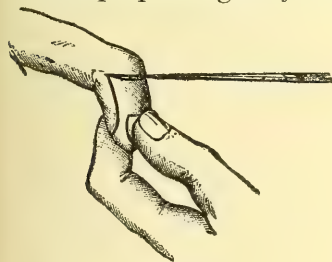


Fig. 921.

The Mode of Holding the Finger During Disarticulation of the last Phalanx.

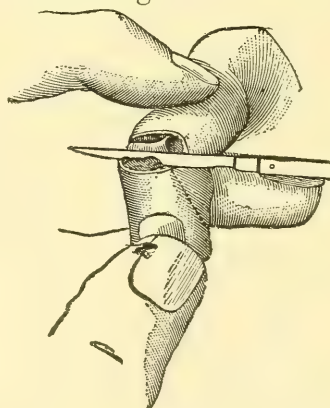


Fig. 922.

Disarticulation of Finger; Long Palmar Flap.

ating in the continuity of the middle phalanx so as to save the insertion of the superficial flexors at its base.

Methods.—The amputation may be either by disarticulation or in the continuity of the bone and is typically done by long palmar and short dorsal flaps, though lateral flaps may be employed. At the metacarpo-phalangeal joint the oval or racket method is usually practiced.

DISARTICULATION BY LONG PALMAR AND SHORT DORSAL FLAPS. For this operation the surgeon will have the hand held in pronation, squarely in front of him, the assistant holding the neighboring fingers out of the way. The fingers are flexed to a right angle over the forefinger of the

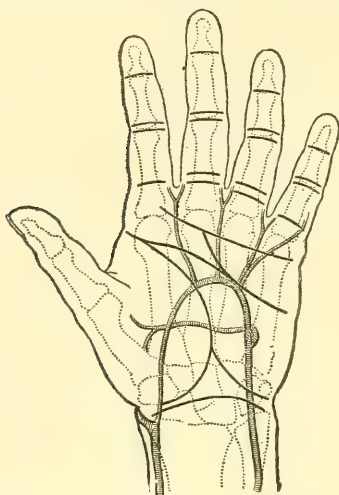


Fig. 923.—Surface Marking on the Palm of the Hand. (The thick black lines represent the chief creases of the skin.)

left hand and with a narrow bladed knife an incision is made against the bony prominence which then presents—as if to split the proximal phalanx lengthwise. This cut will enter the joint. Carefully dividing the lateral ligaments, the distal phalanx can be flexed to a still greater degree. The knife should be passed through the joint and cut along the palmar surface of the bone, hugging it closely; the palmar flap is made by cutting from within outward, leaving it long enough to loosely cover the end of the stump. Occasionally one or two fine ligatures may be required to stop bleeding, but usually the few interrupted sutures required can be so introduced as to control hemorrhage. If the articular cartilage is diseased or lacerated it should be removed. Drainage may be secured by a narrow strip of gauze or strands of silk-worm gut.

In the continuity of the bone, in the middle phalanx especially, the long palmar and short dorsal flaps may be used, but will then be cut from without inward. The dorsal flap should be slightly convex toward the tip of the fingers. This method may be modified by making the dorsal nearly as long as the palmar flap. Equal lateral flaps are coupled with a disadvantageous severance of the tendons, and the tissues of the fingers are too dense to turn back as in the circular method. The bone may be sawed through with a fine saw, or more expeditiously cut with the bone pliers. The flat side should always be placed nearest the body, and a quick cutting and slight rocking motion given to the pliers. Amputation through the bone is done in the middle phalanx, if the proximal half of it is sound, in order to preserve the action of the flexor tendons which are inserted in it. Should these tendons be severed it will be well to stitch them to the end of the stump. Amputation through the proximal phalanx should be done in the forefingers and little fingers, but probably better function and appearances will be maintained if a disarticulation be done at the metacarpo-phalangeal joint of the middle and ring fingers.

The whole finger is removed by disarticulation at the metacarpo-phalangeal joint, usually by the modified oval, racket, or lateral flap method.

MODIFIED OVAL METHOD. This is performed by holding the hand in the prone position, with the neighboring fingers drawn forcibly away. Then an incision on the dorsum of the finger will be begun on the metacarpal bone a half inch above the joint and continued well down over the base of the phalanx, in extent about an inch long and cutting to the bone. The knife will then be carried obliquely around one side of the finger, keeping in front of the inter-digital web, then straight across the palm,

in the crease at the base of the finger and, finally, obliquely up the remaining side of the finger to join the straight cut upon the dorsum. The flaps thus made are dissected back, the finger is over-extended and the articulation opened from the palmar side. Twisting the finger first to one and then to the other side will make the lateral ligaments tense

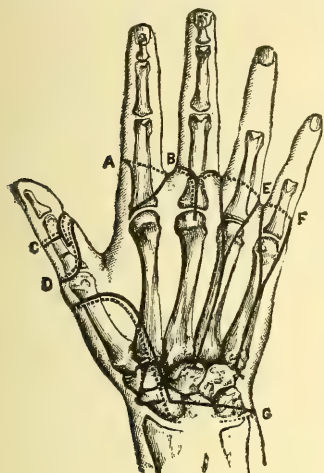


Fig. 924.

A, Disarticulation by special extero-palmar flap; B, Disarticulation by lateral flaps; C, Amputation by unequal dorso-palmar flaps; D, Disarticulation by oblique palmar flap; E, Disarticulation of the ring finger with its metacarpal bone, by racket incision; F, Same operation upon the little finger; G, Dubrueil's disarticulation at the wrist.

and render them more easily recognized and cut. Last of all, the extensor tendons are cut, the bleeding points ligated, the tendons cut squarely off in the stump, and, if it is very desirable to reduce the interspace between the neighboring fingers, the head of the corresponding metacarpal bone is removed by continuing the dorsal incision backward and dissecting the tissues freely enough from the bone to allow the use of the bone pliers, which will readily cut through the neck of the metacarpal bone. But the latter step always impairs, to some extent, the power of the hand, hence should not be taken in the case of laborers. The edges of the dorsal cut naturally come together; the oblique and lateral cuts are easily stitched together. If they have been made below the web the resulting cicatrix is a straight line on the dorsum of the hand, with little or no interference with the tissue of the palm.

RACKET METHOD. This differs from the foregoing in having the dorsal incision extend farther down the fingers and the lateral oblique incision come off above its lower extremity.

LATERAL FLAPS. The method of lateral flaps is performed by entering the knife on the dorsum of the pronated finger, over the joint, then cutting down and on one side of the finger toward the palmar surface where the incision stops at the point directly opposite to its beginning.

The tissues are cut to the bone, the finger held forcibly to the opposite side and with the knife-blade held vertical to the finger, its point above the dorsum, a backward cut is made to and across the metacarpo-phalangeal joint; then, on the opposite side, the second flap is made by cutting from within outward by carrying the knife down the finger along the bone until equally distant from the joint with the flap first made.

This operation gives neat approximation of the tissues, with the blood vessels intact to the ends of the flaps, but has the disadvantage of encroaching unnecessarily upon the tissues of the palm.

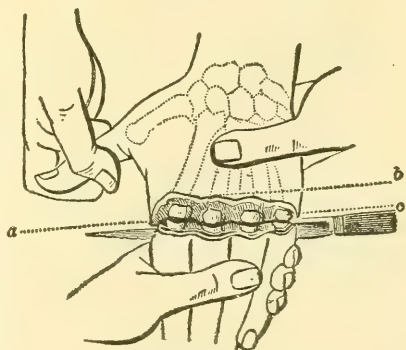


Fig. 925.

Amputation of Phalanx.

If in any case the metacarpal bone is diseased so as to require removal this may be accomplished by continuing the dorsal incision backward over it and dissecting it from its end ligaments.

OVAL METHOD. To remove the fore-finger by the oval method Jacobson advises making the straight incision on the radial side of the joint, while Treves and Kocher place it as near as possible to the middle finger. In both cases the head of the metacarpal bone will be removed obliquely, so as to leave the least prominence possible. The same difference in operation is advised for the little finger.

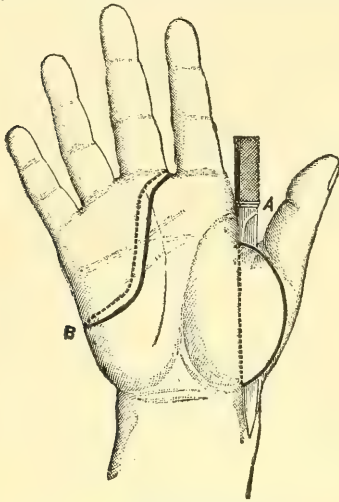


Fig. 926.
Thumb Amputation by
Palmar Flap.

Thumb Amputation.—The bones of the thumb are well supplied with individual muscles, a fact which gives it great mobility and, fortunately, carries it out of the way of many accidents and, moreover, gives the patient control of any stump which may be left after amputation. In all amputations of the thumb there must be kept in mind the importance of its function in grasping and holding objects. Amputation of this member may be a disarticulation or in the continuity of the bone and by whatever flaps will give the longest and most useful stump.

The terminal phalanges may be removed by the long palmar flap as described for amputation of the fingers.

In the proximal phalanx use will be made of any flaps that will give the longest stump, whether antero-posterior or lateral. At the metacarpo-phalangeal joint a disarticulation by the racket or modified oval incision will be effected, remembering that a redundancy of tissue will be required to cover the very prominent head of the metacarpal bone, unless Farabeuf's "U" shaped flaps are adopted. The one is taken from the palmar surface of the thumb, with its convexity toward the tip and the end about opposite the inter-phalangeal joint; the other flap is taken from the dorsum with its convexity toward the wrist and the end opposite the metacarpo-phalangeal articulation. The straight lines of the two "U" shaped cuts meet on the lateral aspects of the fingers. The flaps are dissected back, the tendons cut off and disarticulation completed. The palmar "U" is brought up over the end of the stump and stitched to the dorsal cut. The thumb, together with its metacarpal bone, will be removed by the racket incision, the dorsal cut of which begins in the *tabatière*, just above the carpo-metacarpal joint, and runs along the dorsum a little external to middle line. The oval part of the incision encircles the head of the bone.

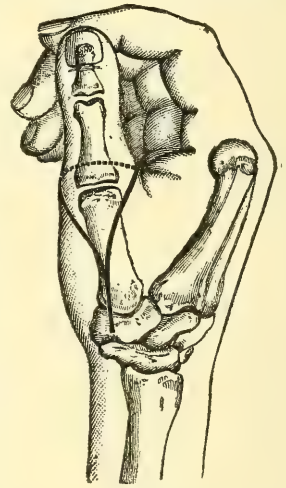


Fig. 927.
Disarticulation of The
Thumb with its Metacarpal
Bone by a Racket Incision.

and crosses the palmar aspect on a level with the web, as displayed when the thumb is abducted. The flaps will be dissected up by keeping the knife close to the bone throughout and rotating the thumb to one side and the other until the disarticulation is effected.



Fig. 928. Metacarpal Knife.

PALMAR FLAPS BY TRANSFIXION. This operation is described by MacCormac for the right hand as follows: The knife is introduced into the centre of the web, is passed toward the trapezium beneath the muscles of the thumb, is made to emerge at the base of the metacarpal



Fig. 929. Metacarpal Saw.

bone and then, by cutting outward, a rounded flap is formed comprising the whole of the tissue of the ball of the thumb. The extremities of this flap are now united by a straight incision across the dorsal aspect; the thumb being still strongly abducted, the remaining soft tissues are divided, the joint opened on the inner side, and the disarticulation is completed.

For the left thumb it will be more convenient to make the dorsal incision first, then the transfixion as above.

This operation, while readily performed, makes a considerable section of the muscles of the thumb and is, on that account, inferior to the racket incision.

Two neighboring fingers may be amputated by the oval method; making the dorsal incision between the metacarpal bones and broadening the oval cut to take in the bases of the two fingers. Often, however, it will be more advisable to remove each finger separately.

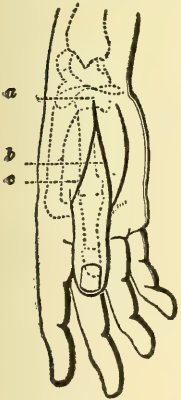


Fig. 930.
Thumb Amputation.

All the fingers may be removed by pronating the hand and flexing the four fingers, then making a curved incision on the dorsum, convex downward, about six or eight lines below the heads of the metacarpal bones, allowing the skin to retract and opening each metacarpo-phalangeal joint, dividing the extensor tendons at the same time—carrying the knife through the articulations to the palmar aspect of the phalanges and cutting the palmar flap from within and down to the folds of skin at the base of the fingers.



Fig. 931.
Thumb Amputation.

All the fingers with their metacarpal bones may be removed by a short dorsal flap and a longer palmar flap, the latter being made by transfixion.

CHAPTER V.

AMPUTATION AT THE WRIST.

Methods.—The principal methods employed at the wrist-joint are the elliptical, the long palmar flap, the circular and Dubrueil's method.

ELLIPTICAL METHOD. This has the highest point of the ellipse on the dorsum, half an inch below the line of the wrist joint, and the lowest point in the palm two inches below the level of the highest point. The incision through the skin and subcutaneous tissues only is made first on the palm with the hand supine. Then the hand is pronated and the dorsal incision is made.*

The tissues are to be separated up to the line of the joint, the pronated hand held in forced flexion and the lateral ligaments, the extensor tendons and the posterior ligaments are divided opposite the articulation.

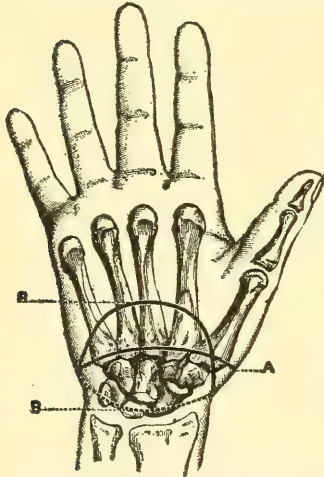


Fig. 932. A, palmar incision in the circular disarticulation at the wrist; B B, incisions in the elliptical disarticulation at the wrist.

The anterior ligament is then severed close to the carpus. The hand, still hanging down in the position of pronation and flexion, is so rotated that one or the other border is turned forward so as to be faced by the surgeon. While in this position the lateral parts of the ellipse are deepened toward the palm, and the two bony eminences at the root of the palm are cleared, the knife being kept close to the bone. The instrument is held vertically, with its point downward, and is passed between the mass of flexor tendons and the hollow of the carpus. With the knife held in this position the "carpal canal" is cleaned out.

Nothing now remains but to divide the flexor tendons and the surrounding soft structures.

The tendons are dragged upon and are cut obliquely from within outward, the knife being held horizontally, and finally following the existing cutaneous incision.

LONG PALMAR FLAP METHOD. In the long palmar flap method the hand will be extended and supinated. The incision will start a half inch below the tip of one styloid process, go straight down the side of the palm, curve around so that the extremity of the broad "U" shaped flap reaches nearly the middle of the metacarpus, then up the opposite side of the palm and end half an inch below the opposite styloid process. This large flap is now dissected back to the level of the wrist joint, and includes all the soft parts down to the flexor tendons, taking care to clear the bony prominences in the palm. The hand is next supinated, and

* The incision should pass between the pisiform bone and the base of the fifth metacarpal bone on the ulnar side, while on the radial side it should cross the carpo-metacarpal joint of the thumb.

the dorsal incision, joining the ends of the palmar incision, is made, it being dissected back to the joint line and the extensor tendons. The lateral, posterior and anterior ligaments are divided finally, the palmar flap is held out of the way, the hand is drawn down from the fore-arm and the flexor tendons are divided with a vigorous cut from dorsum to palm.

CIRCULAR METHOD. In the circular method the incision is made to cross the junction of the fifth metacarpal bone with the carpus and to come one centimeter below the junction of the metacarpal bone of the thumb with the carpus. This circular cut will take skin and subcutaneous tissue only. Dissecting up the integument of the dorsum until the joint line is reached and the styloid process cleared, the lateral ligaments and the extensor tendons are divided and the joint is entered. Finally the hand is brought down and the flexor tendons and remaining tissues are cut in the line of the palmar incision.

EXTERNAL FLAP OPERATION. In the external flap, or Dubrueil's operation, the incision is commenced on the back of the wrist at the junction of the outer and middle thirds and at a point half a centimeter below the line of the wrist-joint. It is then carried downward toward the thumb upon the dorsal aspect of the arm and is made to cross the first metacarpal bone transversely about its middle.

The incision now follows the inner part of the thenar eminence and terminates at a point diametrically opposite to the point at which it was commenced.

The flap is now dissected up to its base and is made to include as much of the thenar mass of muscle as possible. The skin and soft parts internal to the flap are then divided in a circular manner through an incision on a level with the base of the flap and, disarticulation having been effected, the operation is complete. The thenar flap is brought transversely across the face of the radius and ulna and is there secured.

In all amputations at the wrist only the tips of the styloid process should be removed. The cartilage should be removed only if injured or diseased, for if too high a section be performed there will be more interference with pronation and supination later on.

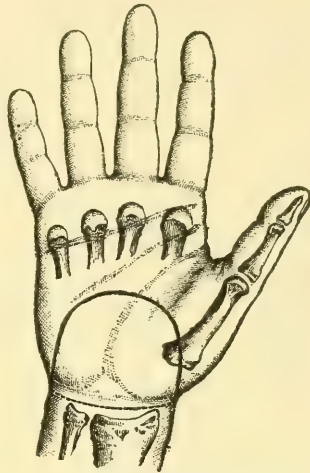


Fig. 933. Disarticulation at the wrist by long palmar flap.

CHAPTER VI.

AMPUTATION OF FOREARM AND AT ELBOW JOINT.

Anatomical Points.—The lower part of the forearm has but little muscular tissue and many tendons in it, while in the upper third it may be composed of very thick muscles, giving this limb a more or less conical outline. It is, moreover, flattened antero-posteriorly, giving an oval outline on section. The bones approach the skin surface very closely in the lower half of the forearm; indeed the ulna is subcutaneous throughout. The amputation will have to be varied according to these facts and the condition of the case.

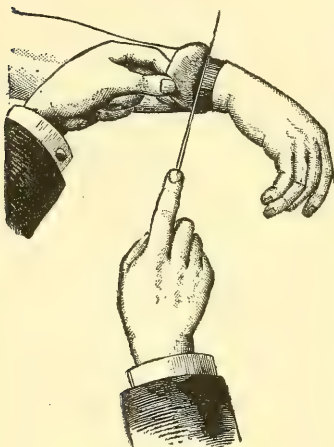


Fig. 934.
Circular Method—Wrist.

Circular Method.—In the lower third the circular method seems to best fulfill the indications. For the right arm the surgeon will stand outside it and for the left arm between it and the body. The arm is held supine, the knife is passed under it and then up and over it until its heel rests upon the side of the arm nearest the operator. The incision is then made by drawing the knife across the flexor side, around the limb to the extensor side and ending at the point where the heel of the knife was first laid. The cuff of skin and the superficial and some of the deep fascia are turned back a distance of about

two and one half inches in an ordinary case. Then a second circular incision is made at the base of the cuff in the same manner as the first, but it should divide all the subcutaneous tissues. With a scalpel the further division of any remaining inter-osseous tissue is done. The soft tissues are strongly retracted by means of the three-tailed retractor and the bones are sawed through together. Should any splinters be left on the bones, they should be nipped off with the bone pliers.

Particular pains must be taken that there be no bleeding from the arteries which lie on the inter-osseous membrane for they tend to retract after being cut.

The circular cuff is replaced, its edges united with interrupted stitches, and drainage provided at the angles.

Flap Method.—The method by skin flaps and circular division of the muscles is applicable to any part of the forearm.

The hand is held in complete pronation and the point at which the bones are to be sawed is fixed with the forefinger and thumb of the left hand. The

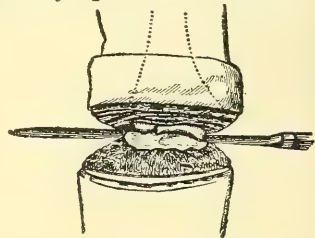


Fig. 935. Circular Method—
Elbow-Joint—Cuff Reflected.

incision is begun at the location marked by the index finger, carried down the lateral aspect of the limb nearly three inches, then suddenly across the posterior surface of the forearm so as to mark out a broad arched flap, then carried up along the side nearest the surgeon to the location

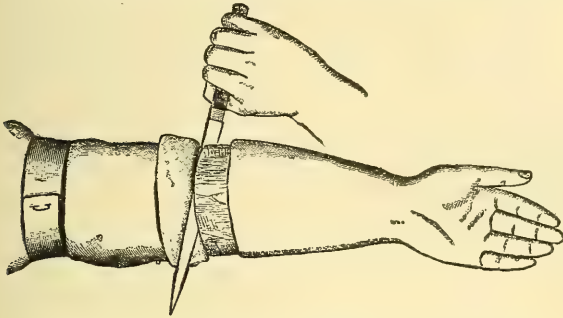


Fig. 936. Division of the Muscle at the Edge of the Turned-up Cuff.

marked by the thumb. This flap is turned upward to include a few muscular fibres if possible. The limb is then turned so that a similar broad flap can be cut from its anterior surface, but not quite so long. The flaps are retracted and the remaining soft parts divided at their base, care being exercised that the

bones are freed of all inter-osseous tissue. The bones are sawed through, projecting tendons cut off, the vessels ligated and the flaps replaced.

Flaps may be made by transfixion in the middle and upper third, when rapidity is required in the operation. The hand is placed in pronation, the tissues are gathered up on the dorsum with the fingers of the left hand, the long knife is thrust through just grazing the bone, cutting downward or forward until a flap of three to four inches is made, and as broad as possible, being sure to make the skin longer than the muscles and bluntly rounded at the lower end. The forearm is now turned and a similar flap is cut from the anterior surface but not quite so long, care being exercised that the knife enters and emerges at the angles made by the first transfixion.

The flaps are retracted, the remaining soft parts and inter-osseous tissue are severed and the operation is completed in the same manner as the former operation.

The transfixion operation high up in a very muscular forearm often allows the protrusion of muscles between the skin edges. Treves first outlines the skin flaps by a superficial incision, allows the skin to retract fully and then transfixes the muscles, following closely the line of the retracted skin.

Or a long anterior flap, four inches or more, may be cut by transfixion, and a short posterior flap, two inches in length, may be made from without and the operation completed.

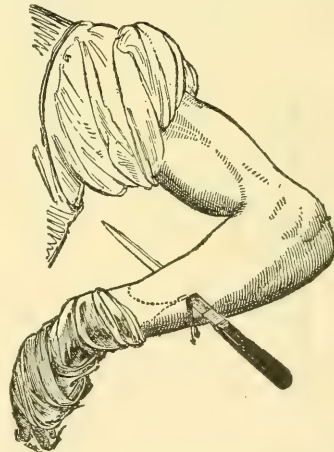


Fig. 937. Transfixion Method.

The circular operation is not so advisable in the upper third of the forearm.

Anatomy of the Elbow-Joint.—The following anatomical facts must be borne in mind: The prominence of the internal epi-condyle is a full inch above the line of the articulation. The external condyle is less prominent and is three-quarters of an inch above the joint. The head of

the radius lies a thumb's breadth below the external condyle. The olecranon rises above the direct joint line and hooks around the condyles of the humerus, and the triceps is attached not only to its tip but its sides as well. The muscles attached to the external condyle retract more

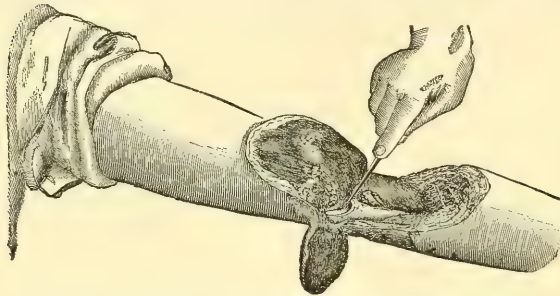


Fig. 938. Amputation through elbow-joint by anterior and posterior flaps at moment of disarticulation.

The forearm is completely supinated, the tissues are raised in front of the joint with the left hand, and the surgeon sends the knife across just in front of the joint on the left side, entering it an inch below the internal and bringing it out an inch and a half below the external condyle. He will cut a well-rounded flap three inches long, being careful to make the skin longer than the muscles. Then passing the knife behind the limb he cuts a flap one and a half inches long from the base of the first incision. Reflecting both flaps, he opens the joint from the outer side, divides the lateral ligaments and finally the triceps. The anterior flap is brought over the condyles and attached with the usual sutures.

ELLIPTICAL METHOD. The elliptical method has its highest point behind the prominence of the olecranon. The lowest point is on the anterior surface, a little above the middle of the forearm. The surgeon may stand at the inner side of the right arm and the outer side of the left arm. Grasping the wrist with his left hand and flexing and rotating the forearm, he begins the incision on the olecranon and carries it down on the farther side of the limb, then to the lowest point of the ellipse on the anterior surface, then up on the surface nearest him and back to the olecranon.

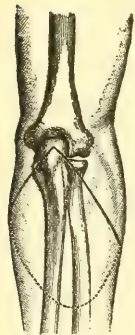


Fig. 939. Disarticulation at the elbow-joint by the anterior ellipse method.

This incision involves the skin only. Allowing it to retract, the surgeon then transfixes the limb transversely as near the joint as possible and forms the anterior flap, following the lines of the retracted skin. The joint is opened at its outer side and the operation completed as above. Or the olecranon may be sawed through and left in situ.

CIRCULAR METHOD. The circular incision should be made obliquely to prepare for the unequal retraction of the muscles and should be three inches below the joint-line, over the supinator longus and one and one-half inches below that level over the ulna. The first incision involves the skin only and is made in the usual manner of a

powerfully than those on the inner side. The joint is more readily opened on the outer side.

Methods for Elbow Joint.—First, the long anterior and short posterior flaps; Second, the elliptical; Third, the circular; Fourth, the lateral flap.

LONG ANTERIOR AND SHORT POSTERIOR FLAPS.

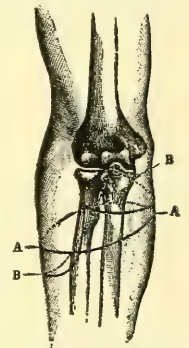


Fig. 940. A, Disarticulation at the elbow-joint by circular method; B, Disarticulation at the elbow-joint by single external flap.

circular cut. The cuff is retracted to one inch below the joint, then the superficial muscles are cut by another circular sweep. This is reflected to the condyles and the remaining muscles are divided at that level. Disarticulation is accomplished and the operation is completed as above.

LATERAL FLAPS. Two equal lateral flaps may be formed with circular division of the muscles, or a single flap may be taken from the external portion of the forearm.

CHAPTER VII.

AMPUTATION OF THE ARM AND AT THE SHOULDER-JOINT.

Anatomical Points.—The muscles stand out prominently in muscular subjects and in them especial attention must be given to the retraction which takes place on section. The grooves at the sides of the biceps and the presence of the brachial artery on the inner side must be remembered. The musculo-spiral nerve adheres tightly to its groove in the bone and should be well taken up before sawing, to prevent mangling by the saw.

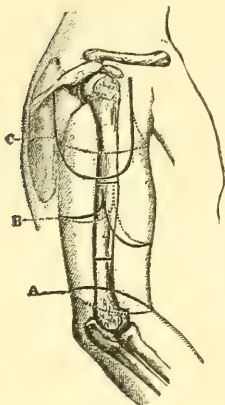


Fig. 941.

A, Circular (inclined) amputation of the arm; B, Amputation of the arm by antero-posterior flaps; C, Amputation at the shoulder-joint by deltoid flap.

Methods of Operation.—The circular, antero-posterior cutaneous flaps with circular division of muscles, and the antero-posterior musculo-cutaneous flaps.

CIRCULAR METHOD. The patient lies on his back near the edge of the table and the surgeon stands on the outer side of the right arm or the inner side of the left arm and fixes the arm with his left hand. His right hand, holding the knife, is passed under the patient's arm up on the opposite side, and bending the wrist over the patient's arm the incision is begun with the heel of the knife on the side nearest himself. The knife is then drawn entirely around the arm, dividing the whole circumference of skin and connective tissue at one cut. The integuments are now retracted two and one-half or three inches.

At the very base of the cutaneous retraction a second circular sweep is now made, which will divide all the muscles down to the bone (the biceps may be first divided an inch below the intended cut since it retracts more markedly than the remaining muscles).

The periosteum is divided and the soft tissue pushed upward still farther, three-fourths of an inch, and held back by the assistant with retractors, and the musculo-spiral nerve is freed from the bone. The bone is now sawed through and the soft parts brought together over the end of the stump.

ANTERO-POSTERIOR CUTANEOUS FLAPS, WITH CIRCULAR DIVISION OF MUSCLES. With thumb and fore-finger of left hand two points are fixed on the lateral aspect of the limb to be amputated, thus marking the level at which the bone is to be sawed. Then with a scalpel a broad U-shaped flap is made on the anterior surface of the arm; next the arm is raised and a similar flap is made posteriorly, one flap a trifle longer than the other so that together they will loosely cover the end of the stump. These flaps are dissected back with short touches of the scalpel, its edge

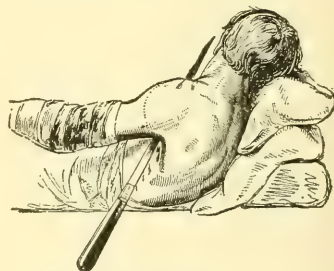


Fig. 942.

Amputation at shoulder-joint.
—Ferguson.

being directed always toward the bone and away from the base of the flap to prevent scoring it. With a long knife a circular division of the muscles is made by putting the knife first under and then up on the opposite side, across the upper surface of the arm, the incision being begun on the side nearest to the surgeon.

The periosteum is cut through and the soft tissue is reflected upward three-fourths of an inch farther. The bone is sawed through, the periosteum and muscles are brought into place and, lastly, the flaps are coapted.

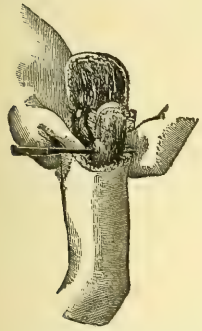


Fig. 943. Shoulder-joint Amputation, anterior flap.

ANTERO-POSTERIOR MUSCULO-CUTANEOUS FLAPS.

In order to avoid the disadvantageous bulkiness of muscles due to the greater retraction of skin in the ordinary transfixion, Treves makes first a broad U-shaped anterior flap of skin and connective tissue, in length equaling the diameter of the limb, and a similar posterior flap half as long. Both of these are cut from without. They are allowed to retract, then a long knife is inserted at one of the angles formed by the junction of these flaps, is thrust through the muscles, just grazing the bone and brought out at the opposite skin angle. The muscles are cut from within, following the line of the retracted skin. The knife is reinserted at the same angle as above and brought out at the opposite side after having grazed the other surface of the bone. A similar cut is made of the remaining muscles from within.

The fibres which remain about the angles and the periosteum are now divided and all reflected a distance sufficient to bare the bone, which is then sawed through. The inner angle for these flaps must never be placed directly over the brachial artery lest the point of the knife split the artery above its point of final section.

The most rapid and brilliant operation in the arm is done by making with the long knife an anterior musculo-cutaneous long flap from without inward on the upper surface of the arm. Then, not raising the knife from the wound, its point is started from the angle nearest the surgeon and thrust beneath the bone and a posterior flap cut from within outward. The periosteum will be divided, the tissues pushed up and the bone sawed, and the remainder of the operation completed as usual.

Anatomy of the Shoulder-Joint.

—The acromion process is important as a point from which incisions start, and as maintaining the general contour of the shoulder after the arm has been removed. Note also the presence of the axillary artery and vein and various branches. The surgeon must bear in mind the laxness and thickness of the capsule of the joint and that it can be most easily exposed by carrying the elbow across the chest. The various muscles attached to the bone should also receive due consideration.

Methods of Controlling Hemorrhage.—First: Pressure upon the subclavian artery above the clavicle and against the first rib, made

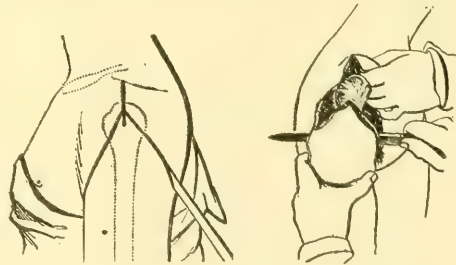


Fig. 944. Anterior-posterior flap method.

by the fingers of an assistant or the classical door-key handle. Even with the most skilled assistant hemorrhage is possible, and will be due to the necessary manipulation of such a large member and the easy displacement of the finger or key.

Second. Compression of the main artery in the flap by an assistant before it is incised.

Third. Exposure of the artery in the flap and its ligation before incision.

Fourth. Compression by rubber bands and tourniquets.

These are all likely to slip unless fastened by Wyeth's pins. One of these is inserted at a point midway in the inferior margin of the posterior axillary fold, and makes its exit about an inch inside the tip of the acromion process. The other pin

Fig. 945. Shoulder-joint Amputation—Control of Hemorrhage.

is introduced at a similar point anteriorly and emerges in front of the clavicle in a position corresponding to the posterior pin.

Methods of Operating.—Lisfranc notes no less than thirty-six procedures under this head. Nearly all of these are modifications in minor details of either the oval or racket methods.

POSITION.—In Larrey's, Spence's and Dupuytren's methods the patient lies close to the edge of the table with the shoulders raised and the head turned to the opposite side.

LARRY'S METHOD. A vertical cut is commenced just below and just in front of the acromion process. It is continued down the arm for four inches and is carried through the fibres of the deltoid muscle. By means of this preliminary wound the shoulder-joint may be explored. From the centre of this incision the oval part of the racket is commenced and is carried across the front of the arm, to pass transversely over the inner side of the limb on a line with the lowest point of the vertical incision. It is finally continued up along the posterior external aspect of the limb to end where it commenced. This cut involves the integuments only. The next incision is through the anterior segment of the deltoid thus exposing the tendon of the pectoralis major which should be divided close to the bone. The coraco brachialis and biceps are next divided, when the artery can be secured and tied. The posterior segment of the deltoid is now divided, the knife going back to the under part of the axilla. The capsule is divided by retracting the flaps, rotating the head and cutting directly down upon the head and tuberosities. The arm is now abducted and rotated outward and thrust upward, so that the surgeon can grasp the head and draw it away from the trunk. He then places the long knife behind the head and cuts the posterior part of the capsule and the remaining axillary tissues.

SPENCE'S METHOD. The author's description is as follows: Supposing the right arm to be the subject of amputation, the arm is slightly

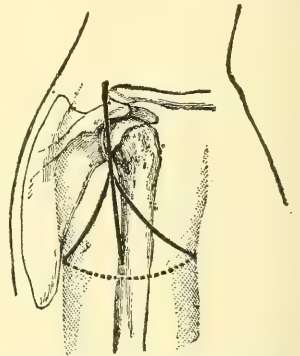


Fig. 946. Disarticulation at the shoulder-joint.—Larrey's Operation.

abducted and the head of the humerus rotated outward if possible. Then with a strong bistoury the operation is begun by cutting down upon the head of the humerus, immediately external to the head of the coracoid process, the incision being carried down through the clavicular fibres of the deltoid and pectoralis major till the humeral attachment of the latter muscle is reached, which is divided. Then, with a gentle curve, the incision is carried across and fairly through the lower fibres of the deltoid, towards the posterior border of the axilla, unless the textures be much torn. The incision so far is carried the whole length directly down to the bone.



Fig. 947.
Inter-Scapulo-Thoracic
Amputation.

The next step is to mark out the line of the lower part of the inner section, by carrying an incision through the skin and fat only from the point where the straight incision terminates—i. e., at the lower end of the insertion of the pectoralis major—across the inside of the arm to meet the incision at the outer part. This assures accuracy in the line

of union but is not essential.

If the fibres of the deltoid have been thoroughly divided in the line of incision, the flap so marked out can be easily separated, without further use of the knife, from the bone and joint by the point of the finger, together with the trunk of the posterior circumflex, which enters its deep surface and can be drawn upward and backward so as to expose the head and tuberosities.

The tendinous insertions of the capsular muscles, the long head of the biceps and the capsule are next divided by cutting directly on the tuberosities and head of the bone, the humerus being rotated by the assistant as required. The broad sub-scapular tendon especially, being very fully exposed by the incision, can be much more easily and completely divided than in the double flap method. By keeping the large outer flap out of the way by a broad copper spatula or the finger of an assistant, and taking care to keep the edge of the knife close to the bone, as in excision, the trunk of the posterior circumflex is protected. Disarticulation is then accomplished and the limb removed by dividing the remaining soft parts on the axillary aspect.

This last step is accomplished, more particularly, by the assistant abducting and rotating the arm outward, then pushing it upward till the surgeon can grasp the projecting head of the bone. He then draws it away from the trunk while the knife is passed behind the bone so as to cut the posterior part of the capsule and the remaining tissues of the axilla. The edges of the wound will be brought together vertically.

DUPUYTREN'S METHOD. The deltoid flap method is thus described by Agnew: The arm being carried off at a right angle with the body in order to relax the deltoid muscle, while the patient is in a semi-recumbent position the surgeon pinches up the thick cushion of flesh overlying the shoulder, and, introducing the point of a narrow-bladed knife two inches posteriorly to the acromion process pushes it directly across the front of the joint, it shaving as it advances the capsular ligament, and brings it out a little external to the coracoid process of the scapula. The transfixion

being accomplished, the knife is made to follow the surface of the bone and to cut a rounded flap which shall terminate immediately above the insertion of the deltoid muscle, and which is to be turned up and held out of the way by an assistant.

The surgeon next draws the arm inward and backward, making the head of the bone prominent, and proceeds to divide the capsular ligament. He afterwards severs the tendons of the biceps and scapular muscles. This will be facilitated by inward and outward rotation of the arm as in the Larrey method.

The bone being now displaced from its socket, the knife is passed across the inner surface and the internal flap formed by dividing all the structures on this aspect of the arm, terminating the cut in a rounded manner at the point where the folds of the axilla join.

FURNEAUX-JORDAN METHOD. This method is adapted to the shoulder-joint by making a circular division of all the soft parts three or four inches below the axilla, the humerus being then shelled out by a longitudinal incision along the outer and posterior aspect of the limb, meeting the circular incision at a right angle.

The selection of a method at the shoulder-joint will depend upon the extent of the disease or injury and the parts involved; indeed, in view of the many procedures that have been advised it will be well, as Jacobson says, to remember the length and size of differently named flaps, to be thoroughly familiar with the anatomy of the parts, the position of vessels, and the best means of controlling the hemorrhage.

At times, the outer part of the shoulder being destroyed or shot away, a flap must needs be taken from the axillary surface and brought up over the cavity. It is even possible to bring covering from the chest or back in case of necessity.

Removal of the Whole Arm With Scapula.—The prime danger in this operation is hemorrhage, the other dangers, the entrance of air into the veins, shock and septic infection. The operation has been most carefully studied by Berger and his method is the best.

Two flaps are made, one taken from the front and axilla, the other from the neck and scapula.

The incision is begun, first, at the outer border of the sterno-mastoid muscle and is carried horizontally along the clavicle to a point beyond the acromio-clavicular junction. The clavicle is divided at the junction of its inner and middle thirds and the outer part is drawn upward and outward. The subclavian artery is now exposed and doubly ligated; then the vein is likewise treated and both are divided between these ligatures.

Secondly, the arm is to be drawn away from the side, and the anterior incision, beginning at the middle of the clavicular incision, is curved downward and outward, passing outside the coracoid process, then to the outer side of the groove between the deltoid and the pectoralis major muscle, across the lower border of the latter and transversely across the axillary surface of the arm, reaching the lower margin of the tendons of the latissimus dorsi and teres major muscle. The limb is well raised and the incision is carried down to the posterior surface of the inferior angle of the scapula and there ends.

Thirdly, the arm is carried across the chest and the posterior incision is begun at the end of the clavicular incision first made, or at the acromio-

clavicular junction, and is carried by the shortest route posteriorly across the scapular spine down to the inferior scapular angle where it meets the anterior incision. The muscular attachments are divided in turn and some vessels will require ligature, the acromio-thoracic, the long thoracic, the supra-scapular and the posterior scapular, besides some muscular branches, which should be caught as they are cut. Despite the major character of the operation the mortality is given by Treves as twenty per cent. in non-traumatic and thirty and three-quarters per cent. in traumatic cases. Agnew gives a list of fourteen cases wherein the entire limb and scapula have been avulsed by accident and all of them recovered.

CHAPTER VIII.

AMPUTATION OF THE TOES.

Anatomical Points.—The toes are so relatively small that if any part of one is injured or diseased it is more than likely that the entire toe is involved. Besides this, with one exception, the very smallness of their component parts prevents the carrying out of a formal amputation in continuity.

The metatarso-phalangeal joint is a full inch back of the web. The terminal phalanges, except the great toe, are small, almost square bones. The middle and proximal phalanges are longer and more slender. Two sesamoid bones are found beneath the base of the great toe.

Especial care is required to preserve the great toe, because of its usefulness in bearing weight and in walking. When it is removed entire the patient will have a decided limp. The stumps of the smaller toes, if amputated in part, often act as foreign bodies to their neighbors, or stick up in such a way as to become a constant source of irritation to the patient. The heads of the metatarsal bones are not to be removed, except with the most positive indications, such as their complete disorganization.

The Great Toe.—The terminal phalanx may be removed by a plantar flap. First, the toe is flexed completely and the articulation is opened as is done in the fingers; but the plantar flap will be best fashioned by cutting from without inward, since, in any case of injury or disease, it will probably be of irregular outline.

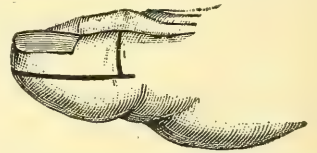


Fig. 948.—Disarticulation of the Last Phalanx of the Great Toe by a Large Plantar Flap.

The proximal phalanx is of importance from the fact that it presents the insertions of the flexor, adductor and abductor tendons which are used in taking every step. Hence, if possible, this phalanx should be preserved. Amputation in the continuity of this phalanx may be done by flaps—lateral, dorso-plantar, the modified oval or racket, and, by some surgeons, the circular method being employed. Whatever method is selected the scar should be kept away from the sole and the friction of the boot on the inner side of the toe.

The various methods will be practiced in a manner quite the same as when done upon fingers.

Disarticulation of the great toe presents one considerable difficulty, viz.: providing a flap sufficiently large to cover the head of the remaining metatarsal bone. The sesamoid bones at its base render the operation more difficult, though they should not be removed with the toe. The digital arteries, on which the flap depends for nutrition, are quite near the joint and unless considerable care is used will be cut too far back.

METHODS. The modified oval or racket, the internal plantar of Farabeuf, and the internal flap are the methods employed.

The racket method is most frequently used and is done by making a dorsal incision, somewhat toward the median line of the foot, according to Kocher. This incision begins one centimeter above the joint and is continued well down upon the phalanx; it then curves down on one side of the toe, across the sole and up the other side of the toe to join the first incision. The sides of the oval are dissected back, the tendons are cut at the level of the joint which is entered from below and the disarticulation is completed.

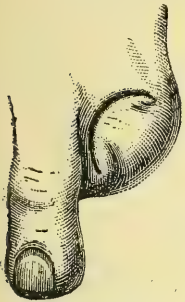


Fig. 949.—Disarticulation of great toe by internal plantar flap: resulting stump.—Farabeuf.

The internal plantar flap method of Farabeuf is performed by entering the knife over the joint line where the internal and dorsal surfaces of the toe meet. An incision is made two c. m. down the toe parallel to the extensor tendon. It is then curved downward over the inner surface to the plantar margin. The toe is now turned in and the knife, placed beneath it, is drawn across the plantar surface to the edge of the web between the toes.

The knife is now held above the toe and the incision completed with a cut, by the shortest route, to the point of starting. This incision includes skin and connective tissue only. The flaps are dissected back and the tendons divided close up to the joint, this being entered from above by forcibly flexing the toe. All the ligaments are divided and the flap is brought up to meet the dorsal incision. In this operation the cicatrix is well placed out

of the line of pressure and excellent drainage is provided.

The internal flap method is thus described by Stimson: The incision is begun on the outer side of the extensor tendon, just below the joint, and is carried straight down to the head of the first phalanx. From its lower end a transverse incision is carried around the inner side of the toe to the outer edge of the flexor tendons and, the toe being then forcibly extended, a plantar incision is carried from the end of the transverse incision along the outer side of the flexor tendon to the digito-plantar fold, and thence transversely around the outer side of the toe to rejoin the first incision near its centre. The internal flap is then dissected from below upward, the extensor tendon divided high up, the lateral ligaments divided, the knife passed through the joint and the remaining soft parts cut from within outward.

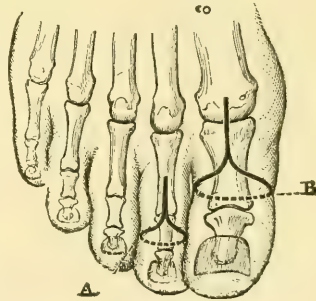


Fig. 950.

(A) Disarticulation of the second phalanx of a toe by the racket or oval incision; (B) Disarticulation of the great toe by the racket or oval incision.

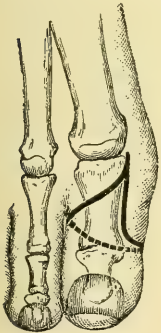


Fig. 951.
Disarticulation of the great toe by internal plantar flap.

The great toe with its metatarsal bone is best removed by the racket method, having the dorsal incision prolonged upward almost to the tarso-metatarsal junction where a short, transverse, internal incision is made to give ready access to the joint. The flaps so made are separated from

the bone, the tarso-metatarsal joint is opened on its dorsal aspect and the toe removed.

The Four Outer Toes.—The terminal phalanges may be removed by a plantar flap as described for fingers.

The result after amputation through the middle and proximal phalanges, or the joint between them, is usually disappointing because of the tendency for the stump to project upward and because of the unequal pressure upon the adjacent toes.

If, however, such an operation be determined upon it may be performed either by the plantar flap or the racket method.

DISARTICULATION. This will be accomplished by the modified oval or racket methods.

A dorsal incision is made, beginning just above the joint or at a point about one inch above the web. The incision is carried well down upon the toe and the oval incision carried from it, as in the corresponding finger amputation.

For the little toe the dorsal incision should be made nearer the middle line of the foot than the middle line of the metatarsal bone, in order to have the cicatrix away from the lateral pressure of the shoe. The little toe may also be removed by cutting through the commissure with the knife held vertically until the level of the metatarso-phalangeal joint is reached; the knife is then turned so as to cut outward through the joint, the toe is forcibly abducted and a flap of sufficient size is cut from within outward.

The little toe with its metatarsal bone is removed by a proceeding exactly similar to that for the great toe, save that the transverse incision is made to the outer side of the bone, and the joint line is much higher in the foot and behind the widely expanded base of the metatarsal bone.

All the Toes En Masse.—This operation may be required in cases of severe crushing or frost-bite, and may be performed by flexing the toes and entering the knife midway between the dorsal and plantar surfaces, directly over the metatarso-phalangeal articulations, cutting first downward to the middle of the first phalanx, then across the dorsum of the base of the toes at the level of the inter-digital web until the opposite side of the foot is reached, where a straight incision is made corresponding to the incision first made. With the toes well flexed this flap is dissected backward and the flexor tendons are divided just below the joints. The joints are entered on the dorsum and the lateral ligaments are divided, then the toes are forcibly extended and a plantar incision is made through the creases at the base of the toes, and the two lateral incisions are joined. This flap is dissected back and the flexor tendons and glenoid ligaments are incised. The flaps will come together easily if sufficient tissue be left over the head of the first metatarsal bone.

Disarticulation of the toes is never accompanied by the removal of the head of the corresponding metatarsal bone, as in case of the fingers.

CHAPTER IX.

TARSAL AMPUTATIONS.

Amputation of Entire Metatarsus.—ANATOMICAL POINTS. In selecting any amputation through the foot it must be remembered that the weight of the body is carried principally on the heel, the outer side of the foot and the ball of the foot; also that the extensor muscles are much stronger than the flexors and if the attachment of these be weakened the foot will invariably point downward; also that the line of the tarso-metatarsal articulation is irregularly curved outward and backward, the second metatarsal bone being mortised into the cuneiform bones back of the neighboring metatarsals, and that the base of the fifth metatarsal is enlarged and projects backward. This gives an undue prominence to the internal cuneiform bone which should be carefully noted.

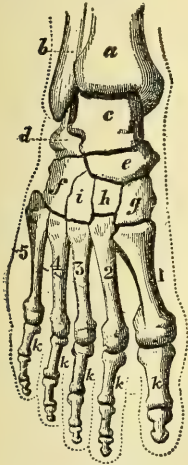


Fig. 952.

a, Tibia; *b*, fibula; *c*, astragalus; *d*, os calcis; *e*, scaphoid; *f*, cuboid; *g*, internal cuneiform; *h*, middle cuneiform; *i*, external cuneiform; *1, 2, 3, 4, 5*, metatarsal bones; *k, k, k, k, k*, penatages.

two centimeters in front of the tubercle of the scaphoid bone.

Hey thus describes his amputation: "I made a mark across the upper part of the foot to point out as exactly as I could the place where the metatarsal bones were joined by those of the tarsus. About one centimeter nearer the toes I made a transverse incision through the integuments and muscles covering the metatarsal bones. From each extremity of this wound I made an incision (along the inner and outer sides of the foot) to the toes. I removed all the toes at their junction with the metatarsal bones and then separated the integuments and muscles forming the sole of the foot from the inferior part of the metatarsal bones. I then separated with the scalpel the four smaller metatarsal bones at their junction with the tarsus, which was easily effected, as the joints lie in a straight line across the foot.

Partial amputations of the foot are apt to be followed by a stump with a tendency to project downward which renders it difficult to fit an artificial foot.

HEY'S AMPUTATION. For this amputation, as well as for Lisfranc's, the surgeon should place his fingers on the lateral aspect of the base of the first and last metatarsal bones. The prominent base of the fifth metatarsal bone renders this easy on the outer side of the foot, while on the inner side it will be a point

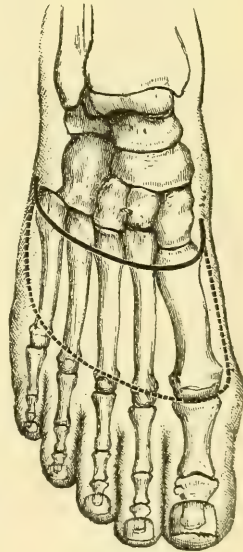


Fig. 953.
Lisfranc's Amputation.

The projecting part of the first cuneiform bone, which supports the great toe, I was obliged to divide with a saw."

Skey disarticulates the outer three and the first joints and saws through the base of the second metatarsal.

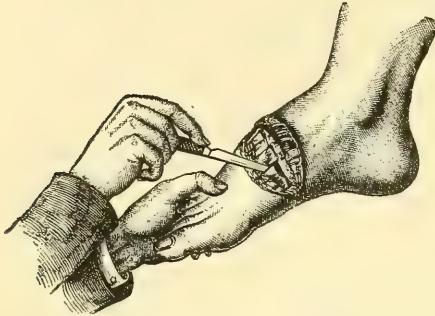


Fig. 954.—The Coup de Maitre in Lisfranc's Amputation: First step. (After Guerin.)

Jacobson says Hey's amputation is usually described by sawing through the bases of the metatarsals.

LISFRANC'S OPERATION. The bases of the first and fifth metatarsal bones are marked by the method described above, and they are joined with a curved incision convex forward that extends well toward the sole and sides of the foot.

Then the foot is flexed and a large plantar flap is marked out by an incision which will begin at one end of the dorsal incision and be carried

forward along the side of the foot to a point in front of the ball of the foot, and will then turn abruptly and cross the sole in front of the ball of the foot and be carried back along the opposite side to join the other end of the dorsal incision.

This plantar flap will then be dissected back, the tissues on the dorsum raised sufficiently to give

access to the articulations, which will be opened from the inner side, it being re-

membered that the second metatarsal bone extends farther back than the first and third and is mortised into the cuneiform bones. Both the dorsal and the plantar flaps should be more fully rounded on the inner side in order to cover the prominent internal cuneiform bone.

Some surgeons prefer to cut the plantar flap from within outward by pressing the long knife between the bones when disarticulation has been completed.

MEDIO-TARSAL AMPUTATION. The typical amputation here is the one described by Chopart, and is done through the articulation just in front of the astragalus and os calcis. The surgeon locates a point halfway between the tip of the external malleolus and

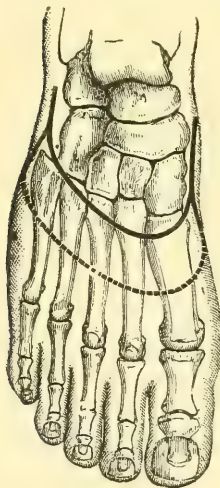


Fig. 956.
Chopart's Amputation.

the base of the fifth metatarsal bone, also the tubercle on the scaphoid bone. He marks these points with the thumb and forefinger of the left hand and joins them by an incision which is convex forward, thus forming a short dorsal flap. From the same points the plantar flap is formed by an incision which extends forward along the side of the foot, and is curved

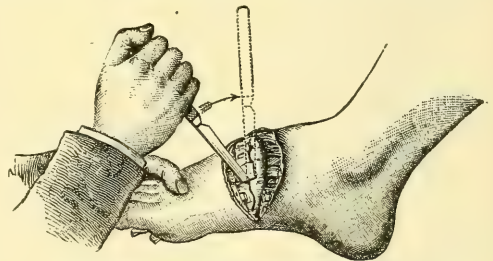


Fig. 955.—The Coup de Maitre in Lisfranc's Amputation: Second step. (After Guerin.)

abruptly across the sole, just back of the ball of the foot, then up the opposite side of the foot to the other end of the dorsal incision. The dorsal flap is dissected back sufficiently to give access to the articulation, which is best reached a half centimeter back of the tubercle on the scaphoid bone. The flaps should come together without tension. The usefulness of this operation is seriously questioned. If done for bone disease the os calcis would probably become easily involved. All the flexor tendons are severed. Hence, the strong muscles attached to the tendo Achillis will probably draw the two bones left backward and upward, and this will bring the cicatrix against the sole of the shoe, and will also bring the sharp

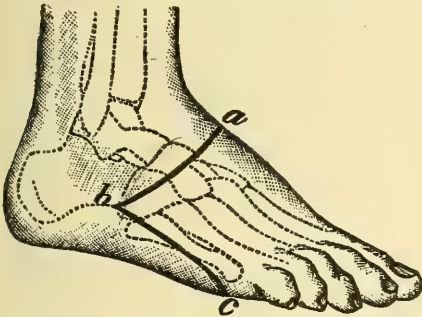


Fig. 957.—Chopart's Lines of Incision
—Helmuth.

anterior edge of the os calcis down on the inner side of the plantar flap.

SUB-ASTRAGALOID DISARTICULATION. This operation, while not very frequently performed, nevertheless gives a good stump and one which has the advantage of preserving some mobility at the ankle-joint. This is an advantage over both the Syme and Pirogoff amputations. The under surface of the astragalus is comparatively smooth and will readily bear the weight of the body.

Of the methods employed the oval is the foundation.

An incision beginning at the insertion of the tendo Achillis is carried forward on the outer side of the foot two centimeters and a

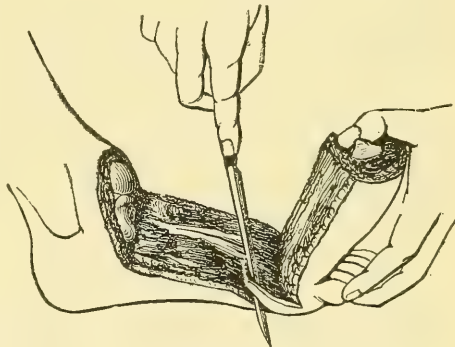


Fig. 958.—Medio-Tarsal Amputation.

half below the external malleolus to the base of the fifth metatarsal bone. It is then carried over the dorsum of the foot and crosses the inner side of the foot at the joint between the cuneiform and the first metatarsal bones.

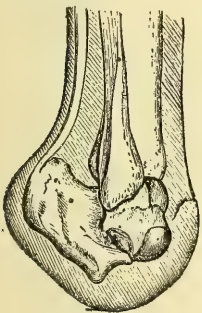


Fig. 959.
Anatomy of the
Stump after Cho-
part's amputation.
(Farabeuf.)

It is then carried across the sole and somewhat backward to reach the first incision about four centimeters back of the fifth metatarsal bone. All the soft tissues will be cut in this line. The dorsal flap will be dissected back to the head of the astragalus. The astragalo-scaphoid joint is opened from the dorsum and the tendo Achillis is divided; then cutting backward, the os calcis is separated from the astragalus, keeping the foot forcibly turned inward during the whole dissection.

Then dissection of all the soft tissues from the inner side of the os calcis is done, still turning the foot inward and upward, and, last, the under surface will be bared, care being exercised to keep very close to

the bone and thus avoid injury to the vessels in the hollow of the flap. If a large cavity be left in the heel-cap a drain may be inserted through an opening into it.

Amputation of the Ankle-Joint.—Amputations at the ankle-joint

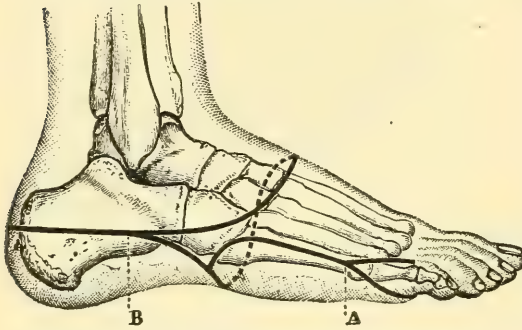


Fig. 960.—A, Disarticulation of the little toe, together with its metatarsal bone, by the oval or racket incision; B, Maurice Perrin's sub-astragaloid amputation.

are, in general, followed by more useful stumps than amputations through either the tarsus or lower part of the leg. In performing this operation the surgeon must note the condition of the os calcis and sinuses around it and the prominence of the malleoli, and must care especially for the blood supply to the heel flap, which largely comes from the posterior tibial artery and its divisions, "on a level with a line drawn from a point on the internal malleolus to the centre of the convexity of the heel."

SYMES' AMPUTATION. The first incision will extend from the tip of the external malleolus, across the sole to within one centimeter of the tip of the internal malleolus; in Syme's words "rather nearer the posterior than the anterior edge of the bone."

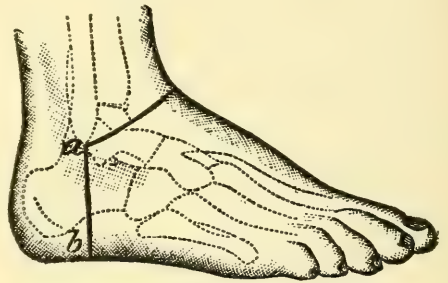


Fig. 961.—Syme's Amputation.—Helmuth.

The second incision crosses the dorsum of the foot, which is held in full extension, and joins the ends of the heel incision. These cuts include all the soft tissues. The heel flap is now forcibly dissected back to the end of the os calcis, keeping the edge of the knife close to the bone. The short dorsal flap will be raised so as to allow the knife to enter the ankle-joint from the front. The joint is thoroughly exposed and the lateral ligaments are divided from within. The foot is drawn still farther down, and the dissection is continued along the upper and lateral surfaces of the os calcis. Then dividing

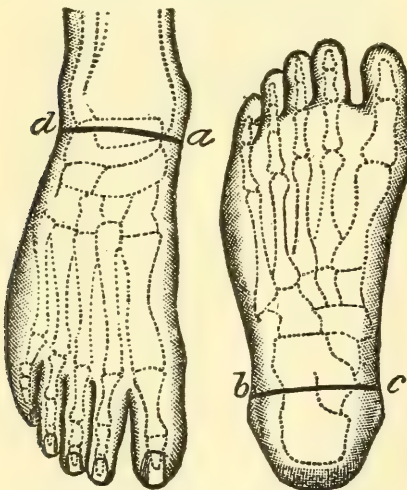


Fig. 962.—Syme's Amputation. *d a*, Anterior incision, *b c*, Posterior incision.

the tendo Achillis, the disarticulation is complete. The tissues are retracted from the malleoli so as to bare the articular surface, and the malleoli and the articular cartilage, about a half centimeter above the inferior margin of the tibia, are sawn off. The dissection must be done by keeping close to the bone and thus avoiding injury to the heel flap. This may be punctured at its thinnest part for the insertion of the drainage tube.

MacLeod has recommended the removal of the malleoli, only leaving the articular cartilage on the under surface of the tibia. The heel flap is stitched to the short dorsal flap and thus completely covers the end of the bone.

ROUX'S OPERATION. The dorsal incision is commenced at the posterior edge of the outer surface of the os calcis, is carried forward just below the external malleolus, and then crosses the dorsum of the foot two centimeters in front of the ankle-joint, to a point between the tubercle of the scaphoid bone and the inner malleolus, and on a level with the tip of the latter process.

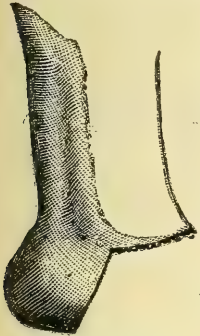


Fig. 963.—Syme's Amputation of the Foot.

The plantar incision starts from the last named point, and, curving forward a little, crosses the inner border of the foot at about the level of the scaphoid bone. It is then carried across the sole to a point about two centimeters behind the

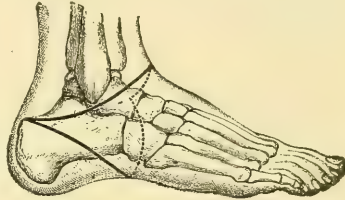


Fig. 964.—Roux's Amputation.

tuberosity of the fifth metatarsal bone, and thence upward to a level with the starting point. The flaps are dissected back as far as possible, the foot is disarticulated, and the soft parts are then dissected away from the inner side of the os calcis. The malleoli are removed as in Syme's amputation. The procedure is difficult and tedious, and, is on the whole, inferior to Syme's operation. The flap, if well cut, is certainly better nourished, but a greater demand is made upon the integuments of the foot.

PIROGOFF'S OPERATION. In order to preserve a greater length of limb Pirogoff retains part of the os calcis. The heel incision is made from the tip of the external malleolus across the sole to a point one centimeter below the internal malleolus. This flap is to be turned backward

one centimeter toward the heel; the ends of this incision are united by one which goes transversely across the ankle-joint in front, the foot being fully extended, the tendons are divided, and the ankle-joint is entered. The lateral and posterior ligaments are divided, the foot drawn still farther downward, and a groove is made in the soft tissue around the os calcis, so that a saw may be placed on the posterior third of its upper surface, and the bone be sawed through

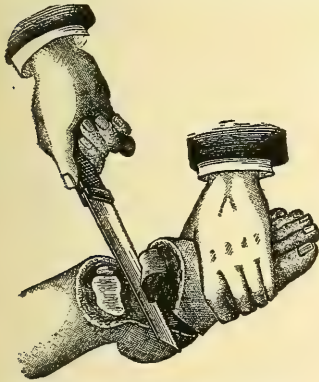


Fig. 965.—Pirogoff's Amputation; Sawing the os calcis.



Fig. 966.—After division of bones.—Pirogoff's operation.

downward and forward. The malleoli are bared and sawed off, together with about one centimeter of the lower end of the tibia. The remaining part of the os calcis is brought up against the end of the tibia, and held in that position by the sutures, or it may be wired.

This amputation gives two centimeters greater length to the limb

than the Syme's operation, and is accomplished by a much less extensive dissection, hence the blood supply will be maintained more perfectly.

LEFORT'S OPERATION. This is a modification of Pirogoff's operation. The incision begins on the outer side of the os calcis at the

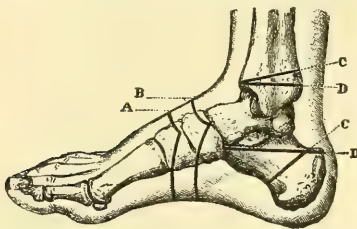


Fig. 967. A. Farabeuf's sub-astragloid amputation; B. Farabeuf's amputation at the ankle-joint; C C. Saw-cuts in Pirogoff's operation; D D. Saw-cuts in Pasquier and Le Fort's operation; D shows also the saw-cut made in the os calcis in Triper's operation.

insertion of the tendo Achillis, is carried forward under the external malleolus, and then across the dorsum of the foot, two centimeters in front of the ankle-joint, and ends just back of

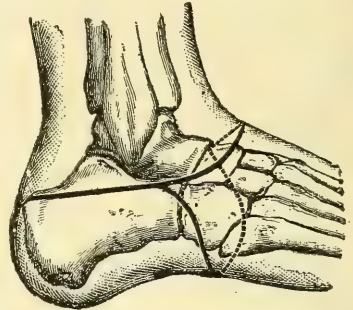


Fig. 968. Pasquier and LeFort's operation.

the tubercle of the scaphoid bone on a level with the tip of the internal malleolus. The plantar incision starts from the first incision, in front of the external malleolus, curves downward to the sole, just back of the base of the fifth metatarsal bone, is carried across the sole, and ends with the dorsal incision. The soft tissues are dissected back and the ankle-joint entered from the outer side, the disarticulation completed and the foot rotated inward, so that the astragalus presents at the outer part of the wound. The astragalus is grasped with forceps, and turned still farther outward, until the inner side of the os calcis is directly upward. The os calcis is cleared, and the saw is applied just below the sustentaculum tali, so as to divide this bone quite horizontally. The ligaments of the calcaneo-cuboid joint are separated and the disarticulation is complete.

The advantage of this operation is that the whole length of the os calcis rests on the ground and the structures are left in a more natural position.

CHAPTER X.

AMPUTATION OF THE LEG.

Application.—This operation was at one time done exclusively at the “point of election,” a hand’s breadth below the knee-joint. The knee was subsequently flexed and a “peg leg” fitted to the stump. The improvements in artificial limbs are such that a much longer stump can be conveniently utilized, and the limb no longer has to be flexed and project backward when the patient walks; indeed, the stump is fitted into the body of the artificial leg and becomes a useful adjunct to safe locomotion.

Anatomical Points.—The anterior surface of the leg is composed of skin and connective tissue alone, hence the anterior flap requires special care in manipulation, so as not to destroy its vitality.

The inter-osseous membrane and the vessels lying upon it should be carefully separated before sawing the bones.

The lower third of the leg is composed of tissues which, though highly organized (tendons and bone), are not vascular and have little reparative powers. A prominent artificial limb-maker says that “between the junction of the middle and lower thirds and the ankle-joint there can be no advantage in saving length of bone.”

The muscles of the calf are thick and should be so cut as not to protrude between the skin edges. These muscles also are, in general, attached only at their ends; hence, when loosened from the tendo Achillis they retract to a considerable extent.

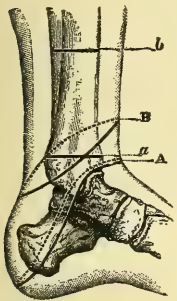


Fig. 969.

(a) Guyon's supra-malleolar amputation; (A) saw line for that operation; (b) Duval's supra-malleolar amputation. (B) saw line for this operation.

Methods.—These are the oblique elliptical incision, (Guyon's supra-malleolar operation), circular incision, oblique circular incision, equal lateral flaps, Teale's rectangular flaps, long anterior flap, long posterior flap, and large external flap (Sedillot's method).

SUPRA-MALLEOLAR AMPUTATION (Guyon.) The incision begins in front of the ankle-joint and is carried in a slightly curved manner from above downward, across one side of the ankle to the point of the heel; a similar incision is made on the opposite side of the heel, passing in each case a little in front of the malleoli. The posterior or heel flap is dissected up, including all the soft parts, to a point four centimeters above the malleoli. The soft tissues anteriorly are dissected up to the same level and the bones are sawed through at the base of the malleoli. The cicatrix is well on the anterior surface of the limb and is out of the line of pressure.

OBLIQUE CIRCULAR INCISION (Kocher.) In performing this operation it is advisable to mark the upper and lower limits of the incision by punctures in the skin. In the upper third of the leg and in the lower third the lowest point of the incision will be anterior and the highest point posterior. In the middle of the leg the lowest point of the incision

will be antero-external and the highest point postero-internal. The upper point will be at the level for sawing the bone, the other sufficiently below it to give an ample covering for the stump. The incision will then begin above and come obliquely down around one side of the limb, crossing it at the lowest point marked anteriorly, then obliquely upward around the opposite side of the limb to the place of beginning. The incision will involve skin and connective tissue only. The integuments will be dissected back to the upper limits of the incision and there a circular division of the muscles will be made. The periosteum should be raised with the soft tissues over the tibia at least a portion of its way around and, after sawing, be allowed to fall over its free end.

It is advised by many surgeons that the fibula be sawed across one centimeter above the tibia; also that the tibia be beveled anteriorly so that no sharp edge be left to make pressure on the inside of the flap. The saw will be held with its point toward the ceiling to saw the right fibula; and with its point toward the floor to saw the left fibula.

TRANSVERSE CIRCULAR METHOD. The circular method, as ordinarily practiced, will require the addition of a longitudinal incision, thus converting the flap into a cuff. When this is placed along the inner edge of the tibia it is known as Lenoir's operation, and is used by French surgeons in the lower third of the leg.

TEALE'S OPERATION. This operation is particularly adapted to the lower third of the leg. The circumference of the leg is measured where the bone is to be sawed, and half that circumference gives the breadth and length of the anterior flap. The posterior flap will be of the same breadth but only one-third the length of the anterior flap. These lines may be marked upon the limb and will be so placed that the lateral incision will follow the margins of the fibula and tibia.

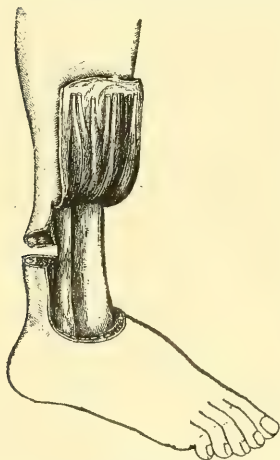


Fig. 970.—Teale's Amputation of the Leg.

The latter incisions extend to the bone and the foot will be thoroughly extended while the incision is being made across the lower end of the anterior flap. This incision will first involve the integument and connective tissue alone, then all the tissues down to the inter-osseous membrane. All the soft tissues are dissected up, and the posterior flap cut with a single sweep of the knife.

All the tissues are retracted and the bones sawed through. The long anterior flap will be brought over the end of the stump and attached to the short posterior flap. The result of this amputation gives drainage posteriorly, and a cicatrix that is drawn well up out of the way of pressure.

LATERAL SKIN FLAPS WITH CIRCULAR DIVISION OF MUSCLES. Standing at the right of the leg, the left index finger is placed on the crest of the tibia and the thumb on the point directly opposite posteriorly. The knife is inserted close to

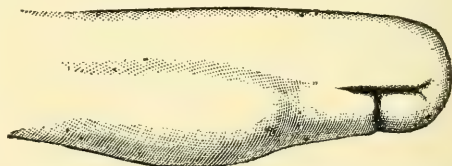


Fig. 971.—Stump Left after Teale's Amputation of the Leg.

the thumb and a cut on the opposite side makes a broadly rounded flap, six or seven centimeters long, ending at the index finger. A similar flap is made on the proximal side. After dissecting these flaps back, at their base is to be made a circular division of the muscles with the long knife. The periosteum is divided and is reflected with the soft tissues a short distance. The division of the inter-osseous tissues is completed and the bones sawed as above described.

EXTERNAL FLAP METHOD. (Sedillot). Ashhurst prefers this operation "to all others for amputation in the upper third of the leg." A pre-

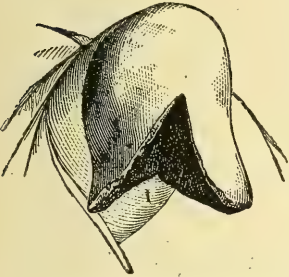


Fig. 972.—Lateral Flaps.

liminary, longitudinal incision through the skin is made along the inner edge of the tibia; the tissues being then drawn to the fibular side of the limb, the longitudinal incision gapes to allow a slender knife to be introduced close to the outer edge of the tibia, to graze the fibula and to be brought out posteriorly, transfixing the limb on the outer side of both bones. The knife is then carried downward close to the bones with a sawing motion and cuts its way outward, forming a broad, rounded flap. The tissues on the inner side of the leg are next divided by an

incision somewhat convex anteriorly, and the bones are cleared by a circular sweep of the knife. The inter-osseous membrane being divided, all the tissues are pushed upward so as to expose the bone two centimeters higher before using the saw.

BILATERAL FLAP METHOD. (Smith). Commencing an incision with a large scalpel in the centre of the anterior surface, it is carried downward and backward along the side of the leg so as to form a slightly curved flap with its convexity below. When the incision passes over the prominent part of the leg toward the posterior surface, it is inclined upward until the middle of the limb is reached, where it should be continued directly upward to the point at which the bone is divided. A similar incision is made on the opposite side. These lateral flaps should consist of skin and superficial fascia. In the leg they should be dissected upward to the extent of two centimeters; in the thigh four or five centimeters. A circular division of the muscles to the bone is next made with a long knife. The periosteum is divided and, together with all the soft tissues, pushed upward far enough to form periosteal flaps from all sides of the tibia, and the bones are sawed through at the base of the periosteal flaps. These latter form a hood for the end of the bone; the skin flaps lie in contact without tension; the drainage is direct from the angle of the wound beneath. When cicatrization is complete the cicatrix lies posterior to the end of the stump and the cushion is freely movable.

CHAPTER XI.

DISARTICULATION AT THE KNEE-JOINT.

Application.—This procedure fell into disrepute soon after its invention because of the frequent infection of the various spaces about the knee-joint. With the perfection of methods of wound treatment it has become one of the most successful operations, and the resulting stump is particularly useful in conjunction with the newer ideas of prosthetic apparatus. Other advantages are less shock, the facts that the tissues of the thigh need not be opened, the muscular retraction is less and the cancellous structure of the femur is not opened.

Methods.—Long anterior flap; long posterior flap; oval method, (Bauden) and lateral flaps (Smith).

LONG ANTERIOR FLAP. Most frequently the disarticulation is done by this method. The surgeon will mark the lowest margin of the condyles of the femur on each side and the space between them and the tibia. He begins the incision at this level,

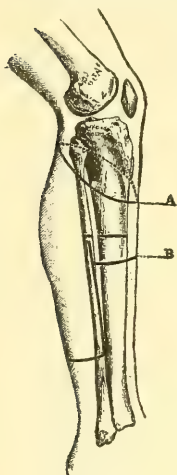


Fig. 973.

A, Disarticulation at the Knee by the Elliptical Method.—Bauden.
B, Henry Lee's Amputation of the Leg.

but rather posterior to the middle line of the condyle, carries it straight down the side of the limb to a level of two centimeters below the tubercle of the tibia, then carries it across the anterior aspect of the limb, making a well rounded flap (or rectangular, as some prefer), and up on the opposite side of the limb to a point directly opposite the beginning of the incision. This cut will involve all the tissues to the bone. Dissecting back the flap the ligamentum patellæ is cut and the joint entered, the lateral and crucial ligaments are divided and a short posterior flap cut from within. The patella will not be disturbed if it is sound, for the dissection required in its removal would endanger the blood supply of a flap which is already too scantily supplied with vessels. The semi-lunar cartilages give a better cushioned stump, and there is no need of removing the articular cartilage if it be sound.

ELLIPTICAL METHOD. (Bauden.) The line of the joint is located and the antero-posterior diameter of the limb is taken at this point. This length below the joint line is measured along the crest of the tibia, giving the lowest point of the ellipse. The upper point of the ellipse will be two or three centimeters below the joint line on the posterior aspect. Beginning the incision posteriorly, it is carried down and around the opposite side of the limb and is broadly rounded across the anterior aspect at the point already marked, then up on the proximal side in a similar manner, to end at the place of beginning. The ellipse is dissected upward, the patellar ligament divided, the joint entered, the crucial and lateral ligaments severed, and, with a single sweep of the knife, the remaining tissues are cut

posteriorly. The cicatrix obtained is transverse, lies posteriorly and gives an excellent stump.

LONG POSTERIOR FLAP. (Hoin.) This operation is advisable only after the failure of an attempted erosion or excision. The long, heavy, musculo-cutaneous posterior flap is almost sure to be dragged away from the short, anterior flap. The operation, having been commenced by opening the joint with a short semi-lunar flap anteriorly, will be completed by laying the long knife across the joint and cutting the long posterior flap from within outward.

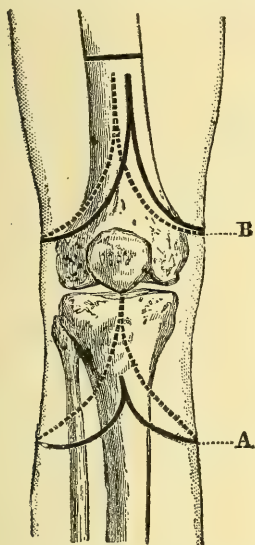


Fig. 974.
Smith's Disarticulation
at the Knee; B, Amputa-
tion of the Thigh by
Lateral Flaps.

LATERAL FLAP METHOD. (Smith). This method causes less disturbance to the vascular supply than any other; hence it promises the best nutrition to the flaps and the least likelihood of sloughing.

An incision is commenced two centimeters below the tubercle of the tibia and is cut to the bone. It is carried downward and forward beyond the curve of the side of the leg, thence inward and backward to the middle of the leg, thence upward to the middle of the popliteal space. The incision is repeated upon the opposite side. Care should be taken that the incisions incline moderately forward, down to the curve of the side of the leg in order to secure ample covering for the condyles; and upon the inner aspect there should be additional fulness for the purpose of insuring sufficient flap for the internal condyle which is longer and larger than the external. The flap, consisting of all the tissues down to the bone, is raised until the articulation is reached, the patellar and lateral ligaments are divided, the joint is entered and its connections are severed internally and

externally. Ample drainage is found posteriorly. The flaps are readily approximated, well nourished and unite rapidly, giving a well rounded stump with the cicatrix sunk in the inter-condyloid fossa.

CHAPTER XII.

AMPUTATION AT THE CONDYLES OF THE FEMUR.

Application.—In any case of disease or injury of the articular surfaces of the femur these must, of course, be sacrificed. Also if the nutrition and extent of the flaps be not sufficient to protect the condyles they will have to be removed.

On the other hand, amputation at the condyles is more favorable than above, and there is less bleeding from small vessels, the medullary canal is not opened, the skin covering the stump is accustomed to pressure, the muscular attachments are not disturbed, hence the patient has better control of prothetic apparatus afterward, especially in adduction, and can possibly bear some weight upon the end of the stump.

Methods.—Carden's: Gritti's trans-condyloid; Stokes' supra-condyloid.

CARDEN'S METHOD. The most prominent part of the condyle of the femur is marked with the forefinger and thumb of the left hand; from this level a well rounded anterior flap is cut which extends down to the middle of the patellar ligament. This flap is dissected backward as thick as may be. At the upper border of the patella, the limb being flexed, the quadriceps tendon is cut and the joint entered. All the ligaments are divided and the joint is cut through posteriorly, together with all the soft tissues. This posterior incision may be made by transfixion after outlining the anterior flap. Next the soft tissues are sufficiently reflected to allow the saw to cut through the base of the condyles.

GRITTI'S METHOD. (Trans-condyloid.) In this operation the patella is retained and fitted against the sawn condyles of the femur.

The condyles being marked as in the previous operation, a rectangular anterior flap is formed by carrying the incision down one side of the knee, straight across at the lowest level of the tubercle of the tibia and upward on the opposite side to a point directly opposite the beginning of the incision. The integument is divided posteriorly by a transverse sweep of the knife. The anterior flap is dissected back and the patellar ligament divided at its insertion. The joint is then opened, all its ligaments being severed. The soft structures are retracted to allow the saw to remove the condyles at their base. The patella should be held vertically, the soft tissues being drawn away, and a thin slice of the under surface of this bone is sawed off. The patella is then adjusted against the condyles, and wired or pegged fast. This latter step is not necessary and is omitted by many surgeons.

STOKES' SUPRA-CONDYLOID METHOD. Inasmuch as the expanded surface of the condyles is much larger than the sawed surface of the patella, Stokes has proposed the sawing of the femur one centimeter above the base of the condyles, and has thereby effected a less strained position for the patella, and one wherein it is less likely to be displaced by any action of the quadriceps muscles.

The anterior flap is broad and oval, and the incision begins two centimeters above the condyles, to be carried down to the level of the tubercle of the tibia. Posteriorly a flap one third the length of the anterior is made and both are dissected upward. The femur is sawed through one centimeter above the condyles. The patella is sawed as in Gritti's operation and placed against the end of the femur. The flaps in this operation are made long to allow for the more marked retraction, owing to the fact that the muscular attachments are severed by the removal of the condyles.

CHAPTER XIII.

AMPUTATION THROUGH THE THIGH.

Frequency.—These operations are frequently performed, the methods employed being most various and considerable difference of opinion existing as to their comparative merits. Thus, Treves notes that one prominent American operator neglects even to mention the circular method, and states that “the superiority of the flap operation is now generally admitted;” and, on the other hand, quotes from Guerin, who says: “*L’amputation de la cuisse est le triomphe de la methode circulaire.*”

Anatomical Points.—The body of muscles in the thigh is rather posterior to the bone. Some of these are attached to the bone only at their extremities, others are attached all the way down; hence, on section, the muscles retract irregularly. The stump left will rarely, if ever, admit of the weight of the body upon its end; hence a prosthetic apparatus must obtain its bearing from the ischium.

The femoral artery in the upper third lies anterior to the bone, in the middle third it is on the inner side, and in the lowest third it lies posteriorly, as the popliteal. In any amputation at or below the middle third, then, it is necessary to guard against splitting or puncturing the vessel above its point of final division.

Methods.—Circular, lateral flaps, mixed flaps and circular division of muscles; antero-posterior flap, long anterior flap and short posterior method (Sedillot), and bilateral flaps (Smith).

CIRCULAR METHOD. The general utility of the circular method in the thigh is questioned chiefly because of the bulkiness and unequal retraction of the muscles. To accommodate this feature the oblique circular method is employed. Farabeuf gives the following directions: On the anterior and outer aspects of the limb the distance between the level of the proposed saw-cut and the incision on the skin should be equal to one-fourth of the circumference at the former point. On the posterior and inner aspects of the limb the skin incisions should be made a little less than half this length lower down.

Having marked the line of incision the surgeon will pass the knife under the limb, up upon the farther side, above and across it, till the heel of the knife is rested upon the side nearest to himself. Then the knife is drawn around the limb in the line previously marked and the skin and connective tissue cut through.

The skin is forcibly retracted and the original obliquity of the incision is maintained. The superficial muscles on the inner and posterior surfaces of the thigh are now divided and these are allowed to retract as much as they will; then the deep muscles are divided to the bone, including the periosteum. The soft tissues are forced upward and clear of the bone retractors which are used and the femur is sawed through. In order to prevent splintering of the bone in the linea aspera it is well to quickly

bring the saw to the vertical position after making the groove, and saw through the *linea aspera* before the remainder of the bone is divided.

In order that the skin may retract sufficiently it may be necessary to make a longitudinal incision at the outer side of the limb. In fact, Syme made two incisions, one on either lateral aspect of the thigh. Some prefer to make the slit at the most dependent portion of the cuff, as it affords a good opportunity for subsequent drainage.

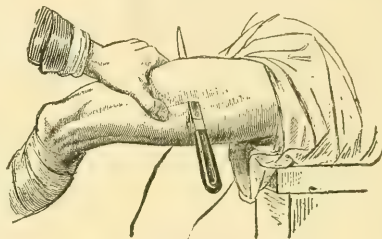


Fig. 975.
Transfixion Method—Ferguson.

LONG ANTERIOR AND SHORT POSTERIOR FLAPS. Farabeuf recommends that the anterior flap be equal in length to one and one-half diameters of the limb at the saw line, and the posterior flap one-half the same diameter. He also

recommends that the anterior flap have a breadth exceeding half the circumference of the limb. Having marked out the anterior flap, the incision is begun at the base of the farther side and cut downward, then with a well rounded curve the incision is carried across the anterior surface and up on the nearer side of the limb, to complete it at a point directly opposite the beginning. The posterior flap is marked out in the same way.

These incisions involve the integument, which is allowed to retract. The anterior flap is grasped with the left hand and the muscles are divided obliquely at the edge of the skin flap from without inward. The posterior flap is most satisfactorily cut by transfixion, thrusting the knife from one angle of the incision to the other and behind the femur. All the soft tissues at the posterior surface are divided, the bone cleared, the skin and muscles retracted, and the bone finally sawed through at as high a level as possible.

Or the operation may be more quickly and brilliantly done by grasping the tissues anterior to the thigh with the left hand, marking the base of the flap with the forefinger and thumb, and cutting with one sweep of the knife—its heel placed on the farther side of the thigh at the point marked by the forefinger—the broad anterior flap, composed of all the tissues above the bone, ending with the point of the knife at the angle marked by the thumb on the nearer side of the limb. Without removing the knife from the wound its edge is turned downward and its point thrust through the limb from one end of the anterior incision to the other back of the femur, and a posterior flap of nearly the same length as the other, consisting of all the tissues of the thigh, is cut. The muscles and periosteum are divided at the base of the flap, all the tissues are retracted, and the bone is sawed as before described.

In all transfixion operations of the thigh if the patient be very muscular the knife may be kept away from the bone while cutting the flaps, thus avoiding the inclusion of all the very deep muscles of the flap. Especially if this be done posteriorly will there be less retraction and less danger of a conical stump,

Both flaps may be of equal length and, cut from within outward, this is the usual transfixion operation. In performing it great care must be taken not to puncture the artery in its course along the thigh in the middle and lower thirds.

Unless the skin incision is made first there is great danger that the muscles will be so prominent as to protrude through the edges of the incision. The anterior flap is apt to be cut too narrow and pointed at its lower end.

TEALE'S RECTANGULAR FLAPS. These flaps are made by the same measurements and methods as described for the leg, and the resulting wound and cicatrix have the same advantages. But it requires the sacrifice of the bone much higher than do the other methods. Besides this the very size of the anterior flap is such that its coaptation with the posterior flap is a difficult matter.

LATERAL FLAPS. (Verneuil.) These at one time were quite popular. They are formed by tranfixion from before backward and were intended to prevent longitudinal section of the artery. In practice, however, it is found that the bone has a great tendency to protrude through the anterior angle of the incision. This is due first to the action of the psoas and iliacus muscles, and secondly to the preponderous weight of the muscles back of the femur. Even if the bone does not protrude the cicatrix is quite likely to be adherent to it.

BILATERAL FLAPS. (Smith.) These are formed as described in the leg amputations, and the cicatrix should lie very favorably on the posterior surface of the thigh.

CHAPTER XIV.

HIP-JOINT AMPUTATIONS.

Complications.—Amputation at the hip-joint is accompanied by three great dangers, viz., hemorrhage, shock and septic infection. That these are very grave complications is readily understood from the high mortality of the operation, which is, in general, 64.1 per cent., according to Ashhurst, and in military service was as high as ninety-three per cent.

The control of shock will require the utmost care before and during the operation and the closest attention afterward, including careful handling, no unnecessary exposure, bandaging of the extremities, careful anesthetization, judicious stimulation and artificial heat.

To prevent infection every step of the operation must be carried out under the strictest rules of asepsis and antisepsis. To prevent hemorrhage many means have been employed. Every case should be provided with infusion apparatus to be used in case of great loss of blood. Preliminary ligation of the femoral or external iliac has been done; but this does not prevent bleeding from branches of the internal iliac, which enter the stump posteriorly and will bleed profusely when cut.

Compression of the common femoral, by the fingers of an assistant or by pads held in place by bandages, is not applicable to fleshy or muscular patients. The taking up the arteries before they are cut prolongs the operation considerably.

Davy's lever, a long-handled pad, is inserted into the rectum and placed upon the common iliac. To the uncertainty of maintaining its position must be added the awkward presence of the assistant holding it and the possible injury to the rectum from its pressure.

Abdominal tourniquets, either mechanical or made for the occasion of elastic bands and compresses, are liable to cause injury to the abdominal contents, intestines, nerves, etc., and in addition the cutting off of the blood current in the abdominal aorta may cause embarrassment of both heart and lungs. Macewen has advised that an assistant, attending at a convenient height to the left of the patient, should compress the aorta with his fist upon the abdominal walls, his arm quite straight and the pressure made by a simple inclination of his whole body toward the patient.

It has even been advised that an abdominal incision be made and that the assistant's hand be introduced within to grasp the aorta during the operation. This has been successfully accomplished. Various elastic bands have been applied with some degree of success. The one disadvantage of them all is that they are liable to slip during the latter stages of the operation when the deep tissues are being separated from the bone. This difficulty has been overcome by the use of Wyeth's long steel needles to hold the tourniquet in place. Their insertion is fully explained in the description of his operation.

Senn has also devised a bloodless method which will be described under the operations.

Methods.—As many as twenty-five different methods are enumerated for this operation. Of these there may be noted the lateral flap method, antero-posterior flap method, the oval or racket, and the circular methods.

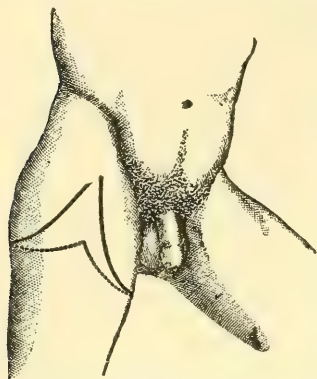


Fig. 976.—Lisfranc's Disarticulation at the Hip by Internal and External Flap.

LATERAL FLAPS. These may be made from within by transection, or from without by dissection. The dissection for the inner flap, beginning, for the right hip, below the tuberosity of the ischium, continues eight centimeters down the inner side of the thigh, then curves upward on the inner and anterior aspects of the thigh to and below Poupart's ligament just outside the femoral vessels. The knife is then carried downward along the anterior aspect, backward across the outer side, just below the base of the great trochanter up to the point of starting. The flaps are dissected up; the soft structure is divided from without inward; the vessels are caught, and last of all disarticulation completed. This method is of value when the thigh is injured or diseased high up on its anterior surface.

ANTERO-POSTERIOR FLAP METHOD. (Transfixion). This is most frequently known as Liston's method and is the most rapid method of disarticulation at the hip. Ferguson states that it can be completed in from twelve to twenty seconds.

The limb is flexed slightly at the hip. The long knife is entered midway between the anterior-superior spine of the ilium and the top of the great trochanter, thrust through the limb parallel to Poupart's ligament and made to emerge at a point two centimeters in front and the same distance below the tuberosity of the ischium. The knife should just graze the head of the femur and open the capsule. An anterior flap, fifteen centimeters long, is formed with a fully-rounded extremity. As soon as there is space the assistant will slip his fingers under the flap back of the knife and grasp the vessels before they are cut. The limb is fully extended, the capsule is opened in front, the femur is rotated outward, the ligamentum teres is divided and the head of the bone is dislocated. The limb is to be raised upward so as to free the head, and the knife is passed back of it. A short posterior flap is cut, ending at the gluteal fold.

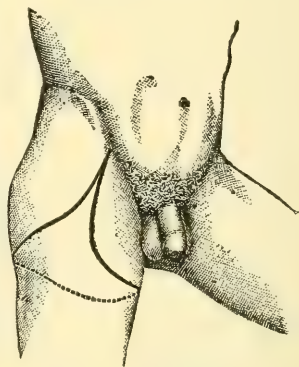


Fig. 977.—Disarticulation at the Hip-Joint by Anterior Racket Incision.

GUTHRIE'S METHOD. This operation is done by short anterior-posterior flaps cut from without inward.

The posterior incision begins a little above the trochanter, is carried downward and across the back of the limb in a curved direction, convexity downward, and terminates in front of the tuberosity of the ischium. The

anterior incision begins and ends at the same points and crosses the limb at least ten centimeters below the joint. The skin is retracted, the muscles divided obliquely from below upward until the joint is reached, when the disarticulation is completed. This method is thought by Ashhurst to be the best mode of amputating at the hip-joint.



Fig. 978.—Transfixion.

known through its modification, the circular method with external straight incision, and this is practiced in two ways—chiefly the Furneaux-Jordan method and Wyeth's method.

FURNEAUX-JORDAN METHOD. Jordan thus describes the operation: "A straight incision was made and the trochanter and upper part of the shaft were freed from their muscular attachments, after which the capsule was opened. Next, the shaft was cleared downward from all its attachments for a considerable distance, and then a few free sawing movements with a long-bladed knife through the thigh, from which the bone had been removed, ended the operation. The integuments were simply drawn upward and the soft parts were cut straight through. No bone being left, the muscles quickly retracted and were easily covered by the skin. The principle of the operation may be thus described: First, enucleate the bone, then cut through the limb at any desired spot."

WYETH'S METHOD. The value of this procedure is made emphatically prominent when statistics are taken. Ashhurst's tables give in 633 cases a mortality of 64.1 per cent.; Wyeth, in 1894, had collected forty-two cases done by his method with a mortality of only 21.4 per cent.

The procedure as given by the author is as follows: "With the patient in the usual position for a hip-joint amputation, the limb should be emptied of blood either by elevation of the foot and lowering of the trunk, or by the Esmarch bandage applied from the toes to the trunk. While the member is elevated, or before the Esmarch bandage is removed, the rubber tubing constriction is applied. The object of this constriction—and it is the chief point in the method—is the absolute occlusion of every vessel at the level of the hip-joint safely above the

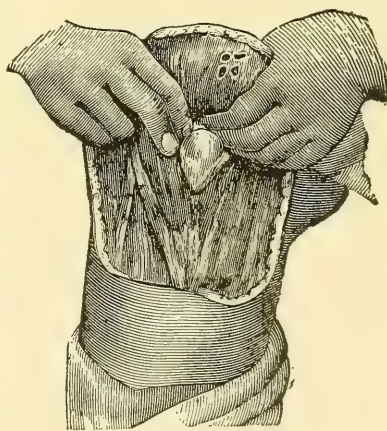


Fig. 979.

Disarticulation at Hip-Joint.

field of the operation, permitting the disarticulation to be completed and the vessels secured before the tourniquet is removed.

“To prevent any possibility of the tourniquet slipping I employ two large mattress needles or skewers, about three-sixteenths of an inch in diameter and ten inches long, one of which is introduced one inch below the anterior-superior spine of the ilium and slightly to the inner side of this prominence, and is made to traverse superficially the muscles and fascia on the outer side of the hip, emerging on a level with and about three inches from the point of entrance. The point of the second needle is made to enter one inch below the level of the crotch internally to the saphenous opening, and, passing squarely through the adductors, comes out an inch below the tuber ischii. The points are at once shielded by bits of cork to prevent injury to the hands of the operator. No vessels are endangered by these skewers. A piece of strong white rubber tube half an inch in diameter and long enough,

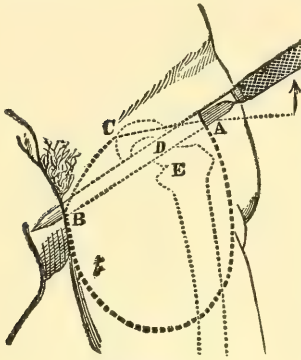


Fig. 980.

when tightened in position, to go five or six times around the thigh is now wound very tightly around and above the fixation needles and tied. If the Esmarch bandage has been employed it is now removed.

“In the formation of flaps the surgeon must be guided by the condition of the limb within the field of operation. When permissible the following method seems ideal: About six inches below the tourniquet a circular incision is made, and this is joined by a longitudinal incision commencing at the tourniquet and passing over the trochanter major. A cuff that includes the subcutaneous tissues down to the deep fascia is dissected off to near the level of the trochanter minor. At about this level the remaining soft parts, together with the vessels, are divided down to the bone by a circular cut, and, in order to facilitate the search for the vessels, the soft parts are rapidly removed from the femur for several inches below the line of the divided muscles. As this stage of the operation the larger vessels, veins as well as arteries, should be tied with sheep-gut. As suggested by Murdock, of Pittsburgh, I now leave the entire extremity intact and use the full length of the limb as a lever in dislodging the head of the bone.

“When the larger and easily recognized vessels have been secured, the muscular attachments to the upper extremity of the bone are lifted off with scissors or knife, keeping along very close to the bone. Holding the soft parts away with retractors, the capsular ligament is exposed and divided in its circumference. forcible elevation, adduction and abduction of the thigh permit the entrance of air into the socket, and at the same time rupture the ligamentum teres and the disarticulation is thus easily and rapidly effected.

“Properly conducted to this point not a drop of blood has been lost, except that which was in the limb below the constriction when this was applied. If now the tourniquet be carefully and gradually loosened each bleeding point may be determined and the forceps applied as required until the tube is entirely removed. Should any difficulty be encountered

in the effort at enucleation (which is scarcely possible) the same precaution in securing all bleeding points should be exercised in removing the tourniquet, and enucleation completed with the tourniquet out of the way."

Senn, also, has proposed an improved "bloodless" method of amputating at the hip. The essential features are that the bone is disarticulated and stripped, as far as necessary, of its soft parts through a long, external Langenbeck incision, before the vessels are secured and without a preliminary high amputation as in other methods. A pair of forceps is forced from within the wound through the inner tissues of the thigh and made to grasp by its centre a piece of elastic tubing, three-quarters of an inch in diameter and about four feet in length, which is drawn through the thigh and out at the external wound. After dividing the tubing the upper half is tied tightly about the soft parts above, while the lower half is crossed beneath the inferior soft parts and its ends brought around the limb and also fastened above. A long anterior and short posterior flap should be preferred and the muscles divided so as to form somewhat of a hollow cone with its open end upward.

SECTION XXXI.

WOUNDS.

CHAPTER I.

CLASSIFICATION AND SYMPTOMS.

Definition.—The term “wounds” as used in surgery implies a solution of continuity of tissue of the human body by means of traumatism—of whatever character—the surgeon’s knife and certain chemical agents, each and all having the power to destroy the integrity of human structures. Ulcers, abscesses and certain other local inflammations may be said to be wounds, in that they are also “a solution of continuity of human tissue,” but these have received consideration elsewhere and will not be brought under the classification of wounds as here viewed.

Classification.—Wounds are open or subcutaneous, depending upon whether the integument has or has not been broken by the injury causing them. It not infrequently happens that severe, even fatal, injury to internal organs occurs by means of force applied from without, the integument not having been destroyed or broken; and not uncommonly subcutaneous structures are lacerated or bruised without material evidences of destruction of the integrity of the skin. Large areas of ecchymosis without integumentary laceration are of common happening.

Wounds are punctured, if caused by a sharp, round instrument, as a shoemaker’s awl, a large needle or other like instrument; penetrating, if caused by a foreign substance, as a bullet penetrating into the tissues; lacerated, if the tissues are torn and rendered ragged and shredded; incised, if clean cut; crushed, if caused by the body or any portion thereof being caught between hard and firm substances with the result that a crushing of the imposed parts ensues; and poisoned, if the injury is inflicted by an animal or weapon that is capable of insinuating poison of any kind into the tissues.

The term gunshot wound sufficiently describes its meaning, while sabre wounds and stab wounds are clearly those caused by the sabre and by stabbing from sharp instruments.

A recent practical classification of wounds is their division into aseptic and septic wounds. Septic wounds are considered by some surgeons under the head of poisoned wounds, since by virtue of the introduction of septic material into the wound, or the development of sepsis therein, a general poisoning of the system takes place through which life is often endangered—as in wounds from poisoned arrows in olden times or wounds that are infected with the poison of rabies, glanders or other animal virus.

It is less accurate, however, to so classify the truly septic wound than to give it its distinctive place.

Wounds are aseptic when they are kept freed of all noxious matter that might produce sepsis. In surgery this is accomplished by the practice of absolute cleanliness, whether by means of sterilized water and dressings alone or by means of the most thorough and systematic application of chemical antiseptics, while subcutaneous wounds are preserved from sepsis, as a rule, because of the protection afforded by the unbroken integument. It goes without saying that the surgeon must in every possible instance render wounds aseptic. In the light of present knowledge it is not difficult to do this in operable cases seen prior to injury or operation. (See Antisepsis and Asepsis.)

In the wounds of accident or other injury it is not always possible, however, to guarantee an aseptic condition. In railway or mill injuries, as in nearly all accidents, there are numerous ways in which septic matter may be brought in contact with the injured surfaces before the surgeon is called—as by means of the implement inflicting the wound, the admission of dirt into the wound, the absorption of septic material from the patient or his clothing, or the development of putrefaction in the wound prior to the surgeon's appearance. Even here, however, it is incumbent upon the surgeon to practice well-known and approved antiseptic measures with the objective view of overcoming, in so far as possible, the effects of septic agents that may have been introduced, since upon the successful combating of their noxious influences depends the life of many wounded individuals. Next to hemorrhage sepsis operates as a factor toward a fatal issue in gunshot wounds, as also in incised wounds. Crushing wounds and lacerated wounds present greater danger from sepsis than from hemorrhage, because the nature of the injury tends to cause occlusion of bleeding vessels and consequent prevention of hemorrhage, while injuries of a character to cause these types of wounds tend toward greater danger from sepsis by the introduction of foreign matter within the abraded, torn and crushed tissues.

Symptoms.—Wounds present symptoms in proportion to their severity and extent. These are both local and constitutional in most cases, though in individual patients there may be practically no local symptoms from even alarming wounds—as in gunshot injuries where there is profound systemic shock and exhaustion from bleeding; while in other cases, and these form the majority, there is greater exhibition of local than of constitutional suffering.

Pain.—In surface wounds pain is a pronounced symptom. It varies, depending upon the extent of the injury, the nature of the tissues involved and the idiosyncrasies of the patient. If a sensory or mixed nerve is injured the pain is severe, while the white matter of the brain may be incised without material suffering (Ashhurst). Crushing injuries are more painful than keenly incised wounds, and lacerated injuries are still more painful, as a rule. Gunshot wounds are not generally severely painful unless a nerve or bone be injured along with soft structures, or unless a vital organ be involved. Such wounds received upon the battlefield often escape notice until hemorrhage calls attention to the injury, or until secondary or reactionary pain is experienced. Wounds that are made instantaneously are less painful than those in which the operating

cause extends over a few seconds of time. Wounds about the head and trunk are usually more dangerous than those of the extremities but they are not necessarily more painful.

TREATMENT. The pain attendant upon wounds is often amenable to remedies that are beneficial in the treatment of shock, as aconite, belladonna, arsenicum, ferrum, gelsemium, hypericum, symphytum and other remedies of this class. In special instances where pain is severe it is but an act of humanity to administer opiates, but it should be borne in mind that they are depressing, and if secondary shock should come on in a given case while under the influence of opium the senses are so benumbed that the surgeon will have greater difficulty in diagnosing the condition, and thus the patient's danger will be increased. As a matter of fact, the routine administration of opiates for pain following upon injuries is deserving of condemnation. More than one case has come under the author's observation in which patients have not rallied from the shock of injury, dying under the influence of narcotics—the cause of death remaining a matter of doubt.

Aconite, even as a routine prescription, will serve a better purpose than opium in any form. It is especially useful when the sensibilities are exalted and the suffering intense. Reactionary fever sets in early, the patient shows signs of delirium, the pulse is full and bounding and all the sensibilities are intensified.

If nerve tissue has been injured hypericum or belladonna, or, perhaps, clematis will be found useful. Magnesia phosphorica is also a remedy of much value.

Shock.—Reference to the Section on Shock will be found advantageous in considering this condition in connection with wounds. The degree of shock that the system suffers is not always consonant with the severity of the injury. The idiosyncrasies of a patient must be considered in this relation. Highly strung and sensitive nervous systems suffer much more severely from shock than do patients of lymphatic temperament. Again, the circumstances and the nature of the injury have much to do with the degree of shock which is produced. With most people the knowledge of suffering a gunshot injury produces a severe degree of systemic prostration, except when the injury is received on the battlefield, the element of fright entering into the production of shock in these instances. In fact, it is not unfrequently the case that even in severe injuries the degree of fright that the patient experiences has very much to do with the degree of shock that is present. The calm, evenly dispositioned individual who is not easily perturbed often sustains severe injuries without pronounced nervous prostration, while, with excitable persons just the opposite is often true, even trifling accidents so completely prostrating the patient that for the time being, at least, the functions of life are severely interfered with.

Shock that arises from active hemorrhage is more difficult to overcome than that due to fright, anxiety or pain. Here the actual loss of vital fluid enters as an important factor into the pathology of the case. Saline infusions, applications of heat, hypodermic injections of brandy, stimulation by ammonia and nitrite of amyl may be required in these cases, though the two latter agents are more especially useful in the nervous variety of shock. Shock continuing in spite of well directed efforts for its

relief augurs unfavorably, especially if internal injury has been received and continuous hemorrhage ensues.

TREATMENT. In the nervous type aconite, coffea, veratrum, ignatia, zincum and similar remedies may be required. If collapse is associated, carbo vegetabilis, veratrum album, camphora and arsenicum are indicated, while staphisagria, nux vomica, cuprum, colocynthis and similar remedies will be demanded if the abdominal viscera and nerve-plexuses be involved. Staphisagria is perhaps the best remedy of all mentioned for abdominal shock, whether it be the shock attending upon abdominal injuries or operations. Hypericum is also a remedy of value in the nervous variety of shock, while symphytum is especially indicated in connection with injuries to the bony structures and the prostration and fright incident thereto. For the further treatment of shock reference is made to the section covering this subject.

Hemorrhage.—Next to pain hemorrhage is likely to be the symptom calling attention to a wound. As suggested in the Section on Gunshot Surgery this symptom may be the first to be noticed even in a fatal wounding. If a bullet is shot from a near point it enters with such force that the pain is insignificant, perhaps not noticeable, and if an artery, vein or large internal organ be penetrated by it there may be alarming hemorrhage before the individual is aware of his injury. Hemorrhage causes more deaths in this type of injury than all other causes, sepsis coming next.

In surface wounds hemorrhage is not likely to be severe unless a large line of incision is made, but there will always be more or less trickling or even severe loss of blood to call attention to the injury. If this be arterial the flow is bright and emitted in spurts, while if venous it is darker, more continuous and passive. Capillary hemorrhage shows an admixture of bright and dark blood without the forcible spurting of arterial wounding. In alarming arterial hemorrhage with threatening asphyxiation the escaping stream is darker from admixture of venous blood and lack of oxygenation of the arterial supply. If cardiac paralysis threatens the blood will flow more continuously, or with less pronounced spurting, or perhaps cease suddenly. This phenomenon is witnessed by the surgeon while his bleeding patient is under the influence of chloroform with heart failure threatening, and should always be taken as a diagnostic sign of chloroform narcosis, or of threatened paralysis of the inhibitory cardiac nerve from other cause.

Hemorrhage from small vessels and capillaries usually checks spontaneously or upon the application of light pressure. If a large vessel be divided by a clean incision it will continue to bleed, even till death follows, unless closed by torsioning or ligaturing. When the injury is after the nature of a lacerated or torn wound the blood vessels are more apt to be closed by shrinking within the tissues, these causing sufficient pressure to check the blood flow, or are torsioned by the injury so that bleeding is prevented. Blood vessels that are crushed so that the media and intima roll inward, the adventitia also undergoing slight or partial twisting, bleed but little.

Secondary hemorrhage follows in injuries to the blood vessels that result in suppuration with sloughing of parts of the injured vessels. This result is not uncommon to gunshot injuries, only a part of the external

coat being torn away by the primary hurt, secondary sloughing destroying the middle and internal coats. A punctured artery may also be closed for the time by a blood-clot which eventually softens and washes away, hemorrhage from the point of puncture following.

Hemorrhage from the veins may be more or less dangerous, especially when injury to a large trunk occurs. A continuous flow of dark blood will at once be diagnosticated as venous, and in special cases where the larger part of the blood that is escaping is of venous character, even though there be an admixture of bright blood with it, it will be well to bear in mind that a vein is hurt, while the red blood may be from the capillaries. Venous bleeding is more likely to occur from the distal than from the proximal end of a vein, the valves interfering with the free flow from the proximal division, except when the injury is inflicted to a vein not freely supplied with valves, or when it is near enough to a large trunk for the blood to overcome the check given by them. Venous hemorrhage clots more readily than does arterial, often causing closure of a wound and a check to the hemorrhage by the formation of a clot or thrombus in the tissues composing the wound. The vessel walls retract more readily than do the walls of arteries, and by the combined causes named—retraction and blood-clot—venous hemorrhage is often held in check where arterial hemorrhage would have continued.

SYMPTOMS. Severe hemorrhage is attended by coldness of the skin, pallor, particularly of the face and extremities, syncope, ringing in the ears, spots before the eyes, nausea, vomiting, vertigo, apprehension, feeble, rapid and irregular pulse, loss of consciousness, dilatation of the pupils, and occasionally by involuntary urination and defecation, together with symptoms of sensory disturbance—as convulsions or, just the reverse, anesthesia. These symptoms may all be present in a given case, or they may not be pronounced and numerous at first, the hemorrhage being from small-sized vessels and occurring so gradually that the patient sinks in a gradual oncoming collapse.

PROGNOSIS. Hemorrhage is dangerous in proportion to the amount of blood lost and the ability of the individual patient to bear it. Recovery is possible after the loss of what appears to be an enormous quantity of blood, once the bleeding is checked, except in cases in which the shock produced by the injury is severe and that following upon the blood-loss so further depresses the nervous vitality that reaction is not possible. Internal hemorrhage is more dangerous because of the difficulty experienced in getting at the bleeding vessels for the purpose of ligation. Injuries to the heart or larger blood vessels of the trunk often result fatally within a few minutes, while a penetrating, punctured or incised wound of a large blood vessel of an arm or leg may also speedily bring about a fatal issue if not promptly controlled. Injury to the blood vessels of the lungs, brain or other vital organ is dangerous to the last degree, not alone from its primary influence but because of the secondary troubles which may follow, as pneumonia when the lungs are involved, paralytic states from clot when the brain is the site of the injury, abscess when non-fatal hepatic hemorrhage has occurred, organic kidney lesions when the renal circulation has suffered from injury to its vessels, etc.

Hemorrhage from the region of the neck or throat, whether from injury or the surgeon's knife, requires prompt attention because of the

complexity of the blood supply; axillary and inguinal hemorrhage should always receive prompt attention for the same reason.

TREATMENT. Hemorrhage is generally the most quickly fatal and certainly dangerous complication in emergency surgery and must be promptly met. A cool head and a clear understanding of the necessities of the situation are absolutely requisite to success, and the more alarming the hemorrhage the more urgent the necessity for calmness and intelligence of action.

Compression. Compression by the fingers over the course of the artery or vein injured—on its proximal side, of course—by the surgeon or a bystander is usually the first and temporary resort. In a lacerated wound with exposed vessels this may suffice until a forcep or ligature can be applied. It is not often, however, that a bleeding vessel is sufficiently exposed to admit of this degree of ease in staunching the flow, and carpal or digital compression is more likely to be called into requisition while a tourniquet or other means of mechanical compression is being provided. For a severe cut of the radial or ulnar artery well down on the arm direct compression to the wounded vessel above the seat of injury may suffice. But because of the liberal degree of collateral circulation obtaining in the hand it may be necessary to apply compression both above and below the wound, or, and usually better, over the brachial artery. Especially will this be necessary if both vessels of the forearm are severed.

If the palmar arch be cut like compression will have to be applied pending more permanent measures. Hemorrhage from this site is frequently annoyingly insistent, requiring temporary complete suppression of the blood flow to the part in order to clear the field of injury of hemorrhage during efforts at torsion or ligation of the wounded artery.

Brachial hemorrhage will demand the tourniquet or other means of firm compression in the axilla whereby the axillary circulation may be completely estopped. Here and in the femoral region the tourniquet is an essential instrument, but in its absence a twisted handkerchief with a large knot tied in its centre and applied directly over the wounded vessel will serve an excellent purpose temporarily. A pocket knife, a large key, a small block of wood, two or three silver dollars tied in a handkerchief and applied over the arterial trunk—these and other temporary aids have been successfully availed of in domestic and emergency practice, the object being to apply direct compression immediately over the supplying artery with sufficient accuracy and firmness to temporarily check the blood-flow.

Compression of the iliac arteries is possible in some subjects suffering injuries to the femoral, and even the abdominal aorta may be compressed or grasped by a small hand introduced into the rectum. This vessel is also compressible through the abdominal walls in thin subjects, or it may be reached by a celiotomy where there is sufficient time for this performance and the conditions are favorable. Naturally, however, in emergency cases, where a patient is likely to bleed to death quickly, there is not sufficient time for an abdominal operation, with its necessary anesthesia and other preliminaries. This is only to be considered in this relation when secondary ligation for operation upon the femoral or iliac artery is to be done.

Compression of the blood vessels of the neck is not often feasible

for obvious reasons. It may readily be practiced, however, for the facial, temporal, occipital, frontal and angular arteries, as required. Incised wounds of the scalp sometimes bleed very freely, when temporary compression of the temporal or occipital or both is absolutely necessary. This may be accomplished by digital means or by the head bandage, described in the Section on Minor Surgery, drawn sufficiently snug to compress the vessels of supply. When necessary, a compact compress may be applied beneath the bandage directly over the supplying artery.

Compression to the anterior or posterior tibial at their points of closest approach to the surface may be demanded in wounds of the vessels of the foot, or it may be necessary to go higher for injury to the pedal arteries, as for incision of either of the tibial vessels, and apply compression to the popliteal. If, in turn, this artery be wounded the femoral in Scarpa's triangle should be the site selected for compression.

Compression is at best but a temporizing measure. It may be all-sufficient for the control of hemorrhage from small vessels and for capillary bleeding that is quite profuse, but, as a rule, ligation or torsion of good-sized vessels that are severed is absolutely demanded. Compression may suffice in moderate wounds of the palm of the hand or sole of the foot, especially when the digits can be flexed during compression and when the phalanges can be bound firmly together over a number of hours or a day or two. Digital compression to larger vessels may be continued in special instances over some hours by frequently changing hands, or by a number of persons serving in relay. But, as stated, the measure is usually but a temporizing expedient to be resorted to in emergency pending the arrival of the surgeon or his search for the bleeding vessel.

Torsion. Hemorrhage is checked in a bleeding artery by occlusion of its calibre, by shrinking and contraction of its intima, by the formation of a fibrinous clot in its channel, or by total compression and agglutination of its walls. Torsion is practiced for the securement of these ends, the two conditions of contraction of the intima and complete occlusion of the vessel-walls being secured thereby. It is growing in favor as against ligaturing and in Great Britain has well-nigh supplanted the latter measure with many surgeons. Even the femoral and axillary arteries are being treated by torsion in amputations, it possessing the chief advantage of freeing the patient from the dangers of sepsis arising from the use of ligatures. In torsion the inner and middle coats of the vessel are twisted and curl upon themselves, serving to block the channel and also serving as a nidus for the formation of a blood-clot plug which further secures immunity from bleeding. The external coat is twisted quite firmly and serves also as a mechanical obstruction to the escape of blood from the torsioned vessel, it being eventually and quickly surrounded by and imbedded in a coating of lymph which makes a double guard against secondary hemorrhage.

As commonly practiced, torsion is accomplished by pinching the end of the artery for a quarter of an inch of its length and quickly rotating the artery forcep a few times, allowing it to dangle from or remain attached to the vessel for a minute or two or longer. This is termed free torsion and is considered applicable to small vessels only.

Another method is to seize the vessel at a right angle with its course with a serrated artery forcep and its free end with another, and while

the vessel is steadied in its course with the former the free extremity is rapidly twisted in its axis by a few turns of the second forcep, complete obliteration of the tube being thus accomplished. This method, known as limited or compound torsion, is practiced upon larger vessels, and if thoroughly done and the forceps be allowed to remain in situ for a few minutes it is pronounced all-sufficient for such vessels as the radial, ulnar, anterior and posterior tibial, brachial, popliteal, axillary and femoral arteries. In the United States it is not practiced as commonly or with as much confidence as it should be, perhaps. In England, France and Germany, especially in the first named country, it is evidently growing in favor.

Ligation. Hemorrhage can invariably be controlled by the correct application of a silk or other ligature to a bleeding artery, except, perhaps, in an atheromatous condition of the vessel, when no measure that can be applied can be considered altogether certain to serve the purpose intended because of the lack of compressibility of the vessel-walls.

The best material for a ligature to be buried in the tissues is aseptic sheep-gut or kangaroo-tendon, because of their absorbability. But, on the other hand, absorption is begun within a few hours after their application and there is but little reason why preference should be given this form of ligation over torsion. It is true that compression of the vessel walls is continued longer by animal ligatures than by torsion, but there is the possible danger of sepsis to offset the advantage thus gained, if, indeed, it can be called an advantage. Still, this form of ligature is very much used, and if ligation is to be practiced aseptic animal ligatures are preferable for small vessels and "bleeding points."

For larger vessels silk ligatures rendered sterile by boiling are to be preferred. These should be drawn down upon the artery with sufficient firmness to completely compress the outer wall of the vessel, and as this is accomplished the middle and inner coats are completely divided, curling upon themselves as effectually as if they had been twisted by torsion. They thus block the channel and serve as a nidus for a firm plug which protects from secondary hemorrhage if the ligature should happen to slip or the tied end of the artery should slough.

Numerous methods have been resorted to and are described by surgical authors, but for practical purposes it is enough when an artery is severed and its cut end is exposed to seize it with a serrated artery forcep, draw it away from the surrounding structure, stripping it, if need be, of connecting tissue, etc., and tie it securely half an inch from its severed extremity. The simpler the procedure the better. No complicated or complex maneuvers or knots are required. It may be well to pass the distal end of the ligature over the proximal end twice before drawing the knot down upon the artery, thus accomplishing the "surgeon's knot," this second turn of the thread preventing slipping as the terminals are relaxed in order to make the second knot.

It is not always that the free end of an incised or otherwise wounded artery is exposed so that it may be readily picked up with an artery forcep, and it may be necessary to cut down upon the vessel and ligate it in continuity. To accomplish this an incision is to be made directly over the course of the artery until it is exposed, care being exercised as it is approached not to wound it or its sheath, and as it is brought well into

the wound the selected ligature is passed beneath it by means of the fingers or an artery or aneurismal needle (Fig. 442). In the absence of either of these the eye of a flexible probe may be armed with the ligature and be brought to the proper curve to serve the purpose.

By preference a wounded artery or vein should be tied close to the site of the injury, and, if possible, it should be grasped with the forcep while bleeding and where wounded. In ligaturing even a short distance above the point of incision or severance it may happen that the ligature is placed beyond a branch or branches supplying neighboring parts. For this reason if for no other it is desirable to ligate close to the site of injury.

Good-sized vessels should be tied on both sides of a wound to their coats, for the reason that where collateral circulation is free secondary hemorrhage may occur from the distal direction. Even where an artery is wounded but not completely severed it is safer to ligate upon both sides of the injury.

The ligature of an artery in continuity is illustrated in Fig. I, Plate XIII.

Other Methods of Checking Hemorrhages. Various methods have been adopted for controlling hemorrhages which need but to be mentioned here.

Compression by means of pins inserted below the bleeding vessel with a ligature thrown around their exposed ends (See Minor Surgery), cauterization, tamponading, the application of styptics and other expedients have been resorted to. In special instances it may be wise to employ these measures, but as a rule the methods of clean cut and accurate surgery are to be preferred. Aseptic packing, by means of oakum, or bichlorided or carbolized lint, with firm compression by sterile gauze and the outer bandage may be sufficient to meet the necessities of many cases of passive hemorrhage; but for a severed artery nothing short of complete occlusion by torsion or ligature—all instruments, ligatures and dressings being thoroughly sterile—should be relied upon.

A metal rod heated only to a black or dull red heat may be touched to a persistent bleeding point if ligature or torsion seems impracticable.

Medication. For hemorrhage due to surgical causes and states but little if anything is to be expected of medication, but for concomitant conditions and sequelæ the homeopathic remedy is frequently of no little value.

Ipecacuanha, china, ferrum, digitalis, secale, arsenicum, trillium, nitric acid and other remedies will occasionally be called for. The first named is especially valuable for the nausea, collapse and syncope that attend upon profuse hemorrhage of bright blood. The patient is nauseated and sinks away in a faint from loss of blood. Here ipecac, after the flow is stanching, will serve a good purpose in inducing reaction and restoring the vital equilibrium. China is especially applicable to the exhaustion that follows upon excessive loss of blood or other vital fluid. The patient is not nauseated nor is dyspnea pronounced. The features are sunken, even hippocratic, the pulse is weak, the heart beats faintly and the skin is cold though dry. China and ferrum are always to be considered in the exhaustion that follows hemorrhage. The state is not that of collapse such as belongs to veratrum album, camphora and carbo vegetabilis—the patient is sunken in exhaustion from loss of blood rather than collapse from nerve shock.

CHAPTER II.

POISONED WOUNDS.

Varieties.—Wounds classed as poisoned are those produced by venomous animals, reptiles and insects; those produced by the introduction of various vegetable poisons by means of sharp instruments the points of which have been dipped into woorari, strychnia, upas or other similar poisons, and dissection wounds.

Animal Poisons.—Animal poisons are those of the rabid dog or other quadruped; various reptiles—as the adder, rattlesnake, copperhead and the like; certain insects—as wasps, hornets, scorpions, certain spiders, the honey bee, various house flies and small insects—as bed-bugs and mosquitoes, especially those found in swampy sections. It is probable, too, that poisons not peculiar to the insect wounding the individual may be carried on its sting, systemic infection arising therefrom, as, for instance, typhoid fever and septicemia from the infection of a housefly or other insect feeding upon decaying animal matter.

WOUNDS OF RABIES. Wounds inflicted by a rabid dog, wolf, cat, skunk or other mad animal are exceedingly dangerous, hydrophobia resulting in a large majority of cases not treated promptly. The wounds of these animals and the subject of hydrophobia are discussed in the Chapter on Rabies, and need no elaboration here.

WOUNDS OF REPTILES. The wound of the American rattlesnake is the serpent wound most frequently met with in this country. There are two genera of rattlesnake, the *crotalus*, with fourteen distinct species, and the *cadisona*, of which there are four distinct species. The *crotalus horridus* is the reptile most commonly found throughout the Western and South-western portions of the United States, the *cadisona* being more rare. The wounds of the two genera are about equally poisonous. Besides the rattlesnake there are copperheads and moccasins, divided into four species, and five species of the genus *elaps*.

The general symptoms and treatment of wounds caused by poisonous reptiles in this country are practically the same. The rattlesnake has movable fangs situated in the upper jaw which fold or lie back against the hard palate, but which when the mouth is open and the reptile is in the act of “striking” its foe are erected. At the root of each of the fangs are found the glands containing the poisonous fluid, and as the fangs are inserted into the flesh these are made to forcibly contract, impelling the fluid along their ducts to the fang to be injected into the tissues bitten. Thus the poison is thrown directly into the blood and within a few minutes after its insertion the tissues immediately surrounding the wound become infiltrated, doughy and discolored; local lymphangitis quickly follows, and if the circulation is not immediately constricted above the site of injury the poison is promptly carried into the general system, with resulting systemic intoxication. When young subjects are bitten by a venomous reptile, especially along the course of veins or lymphatics, they are rendered

unconscious within a few minutes, being simply overwhelmed by the toxic effect of the injected virus.

The author was able to observe the ejection of the poison of the *Crotalus horridus* upon one occasion by partially severing the snake's head from its body with a blow from a small ax, the reptile "striking" rapidly and ejecting the poison for a distance of two or more feet. In another instance almost similar a physician was able, by holding a vial attached to a ramrod close to the mouth of the reptile, to procure some of the poison, from which a dilution was subsequently made. Several times during the attempt to secure a portion of the virus the wounded reptile ejected the poison with sufficient force to throw it a distance of several feet.

The rattlesnake and viper differ in the fact that the fangs of the latter are permanently fixed in the jaw, corresponding to the canine teeth of the dog. They are shorter and straighter than the fangs of the rattlesnake, the virus gland is not as large as that of the latter serpent, and the poison is not ejected with as much force. The mechanism of the fang of the rattlesnake is exceedingly ingenious and the power of a vigorous serpent of this species to infect its foe is much more pronounced than that of the viper or any other American serpent. In India the *naja* is even more venomous than the rattlesnake of this country, while other species of serpents are also productive of many fatalities.

Some of these wounds are quickly fatal, while others are dangerous only in their secondary symptoms, others again being painful and not attended by serious results. The poison of the rattlesnake, copperhead and South American adder are especially venomous and fatal, though not invariably so. The older the reptile the greater the danger; the danger is also greater in bites of reptiles that have been angered immediately prior to the infliction of the bite. It is said that the bite of the female snake is more venomous than the male, but the truth of this is doubted. It is also held that there is more danger attending the bite of the American rattlesnake and other reptiles in the fall of the year than at any other season. However this may be, it is an acknowledged fact that in the West and Southwest more deaths occur from snake bites in the early fall months than at any other time of the year.

Pain, at times really severe, attends the bite of a rattlesnake, cobra or copperhead; in other instances it may not be sufficiently pronounced to more than attract the attention of the patient, the cause of the injury not being known to him, as in bites about the leg and foot from an unseen reptile. If a blood vessel is struck there may be sharp hemorrhage, though this is not usually the case. The appearance of the wound made by a rattlesnake, especially by a large serpent, is very much like that made by the bite of a squirrel. The superior maxillary fangs in old serpents are situated from one-quarter to one-half inch apart, and as they are sunk into the flesh the tissues are punctured as though by squirrel teeth. The inferior fangs, though not provided with a hinge-like attachment and not supplied by poison glands and ducts, are yet sufficiently large to abrade the tissues, giving to the wound the appearance of having been made by four separate teeth, two above and two below. As in gunshot injuries so also in reptile wounds, there is a very severe degree of reaction in nervous subjects, caused by terror experienced from the injury and the fear which follows. In other subjects the pain is insignificant,

and instead of there being nervous excitement and apprehension there is mental obtunding with early unconsciousness, in special cases death supervening within an hour from the time of the bite. Hemorrhagic infiltrations occur in different parts of the body, even far removed from the site of the wound, the result of non-coagulable blood, giving to the tissues the appearance of severe ecchymosis. In special instances hemorrhages occur from the mucous membrane of the mouth, bowels and even the eyes, these being especially likely to follow the bite of a naja. In occasional cases a severe degree of cerebral excitement follows the injections of reptile poison into the blood, the patient dying in convulsions; but as a rule the exhaustion is profound and the patient sinks away in rapid systemic intoxication attended by oncoming coma, profound stupor and unconsciousness. In some cases the patient is extremely hot, the temperature quickly rising to 104 or 105 degrees, but oftener the system is profoundly shocked and the patient is bathed in a cold sweat, or perhaps the temperature may be sub-normal, the patient being yet free from perspiration.

Treatment. Alcohol is, beyond question, the best basic treatment for wounds inflicted by venomous reptiles and insects. Iodine, permanganate of potash, ammonia, bromine and other chemicals have been used with varying success. When injected hypodermically in the immediate neighborhood of the wound diluted aqua ammoniæ has proven efficacious where heart failure and profound nervous exhaustion have threatened. The Bibron antidote, consisting of corrosive sublimate, iodine and iodide of potash, has long been a favorite remedy in India, but is being superseded by alcohol. Internal administration of iodine in doses of from five to ten drops, repeated as often as the exigencies of the case demand, to moderate iodism is sometimes successful. In one case coming under the author's care in Texas this treatment was successful for a case of copperhead bite, the patient being overwhelmed by the poison when first seen. In other instances it has proven unavailing. In another case a boy four years old who had been bitten on the palmar surface of the forearm by a three-year-old rattlesnake, and who was quickly overcome by septic intoxication, was saved by hypodermic injections of permanganate of potash. If a case is seen early a ligature should be thrown around the wounded member on the proximal side of the wound and the site of the wound freely incised or scarified. If possible it should be cupped, and if necessary oral suction should be resorted to. Cauterization is of no avail, since the poison is injected into the tissue, but hypodermic injections of carbolic acid or spirits of ammonia directly in the track of the wound, or, better still, underneath the tissues that are infiltrated may be employed with benefit.

The alcohol treatment consists of the free administration of whisky, brandy or dilute alcohol, the quantity varying according to the exigencies of the case and the ability of the patient to bear it. It is remarkable how much alcohol can be taken without intoxication being produced by persons bitten by venomous serpents, yet it is believed that in domestic practice death as often ensues from the over-administration of alcohol to subjects unused to it as from the effect of the virus. Without discussing the principle upon which the cure is supposed to be effected, it is sufficient to state that the burden of testimony is very strongly in favor of a thorough but reasonable saturation with alcohol over a period of hours

or a day or two, as the best means of securing neutralization of serpent virus. It is well to administer large draughts of hot water at frequent intervals during the administration of the alcohol to avoid its ill-effect upon the stomach and for depurative purposes. Hot milk may also be given to subjects with whom it agrees. In children a convenient method of administration of spirits is by adding one or two teaspoonfuls of liquor to a half cup of water and milk, equal parts. When the stomach refuses to tolerate this it may be administered by enemata, and in severe cases it is not amiss to inject dilute alcohol into the veins or sub-cutaneous tissue.

Ether may be used hypodermically in cases threatening heart failure and severe collapse—a ten per cent. aqueous solution being used.

Local Treatment. But little is to be gained by local treatment of serpent wounds. Thorough scarification at the site of the wound may be practiced if the case is seen within an hour after the infliction of the injury, and whether ammonia, iodine, carbolic acid or other substance be injected hypodermically it may be necessary to poultice the wound with linseed meal, slippery elm or other suitable poultice for the purpose of extracting the virus and otherwise cleansing the tissues. As a rule, wounds of this character should be treated on general surgical principles, it being better in such cases to dress them antiseptically, especially after the discontinuance of the poultice.

If an arm or limb be painful, swollen and tense, cloths wrung from hot water perhaps medicated with hamamelis, calendula or arnica and applied over the swollen member will be grateful. A domestic application of some value is a poultice of scraped beets.

Where the circulation is materially interfered with and especially where the temperature is below normal it is necessary to keep the affected part warm by the application of hot flannels, hot-water bottles and the like, care being taken not to produce local burns by excessive heat, the tissues being so benumbed as to be unconscious of excessive therma.

WOUNDS OF INSECTS. The bites of spiders are painful and in exceptional cases fatal. The tarentula is commonly accounted an exceedingly dangerous insect, but, as a matter of fact, its sting is not more venomous than that of the little brown house spider or the small black spider whose fur is studded with white dots.

The poison of the honey bee is occasionally fatal, especially where a swarm of bees attack an individual, in which a genuine battle occurs. In this instance the poison of this domestic insect becomes peculiarly venomous and fatal issues sometimes ensue, the patient dying from convulsions or paralysis of the vagus.

The South American ant and the big red ant of the Southwestern portion of the United States and Mexico are responsible for an occasional fatal issue and for many painful wounds. A case occurred under the author's observation in San Antonio some years ago in which a child two years of age was stung to death by a troop of large red ants common to that country, and a number of instances have been observed in which severe constitutional symptoms have followed upon the sting of this insect.

Treatment of Insect Bites. In a general way the treatment of the bites of venomous insects is the same as that applicable to the bites of venomous reptiles. The tarentula, and even other species of spider, are capable of affecting the system as profoundly in many instances as the

rattlesnake, copperhead or cobra, systemic intoxication quickly following, and coma, unconsciousness and death ensuing within a few hours—especially in young subjects bitten by unusually venomous insects. Here the treatment would be the same as for the rattlesnake bite. A not uncommon result of this form of poisoned wound is the sloughing of the area of tissue that is infiltrated, surrounding the wound; this often becomes gangrenous and sloughs away en masse, while in other cases an ichorous, semi-liquid discharge is observed, extending over a period of days, before the whole affected area will be sloughed away. Wounds of this nature must be treated antiseptically in order to prevent systemic infection and general septicemia.

The pain of insect bites is often promptly relieved and the constitutional effects more or less modified by the direct application of ammonia, iodine, carbolic acid or even a saturated solution of iodide of potash or soda directly over the wounded spot. The mother tincture of *ledum palustre* is an excellent application for insect stings, quickly relieving the pain and inflammation in many instances. Numerous domestic applications are also useful, *hamamelis*, *arnica*, salt-water, clay poultices and various liniments being used with more or less success.

Medication. It is not believed that it is safe to rely upon internal medication for the neutralization of the virus of venomous reptiles or serpents to any considerable extent. It must be borne in mind that the effect of homeopathic medication is largely secured through the influence of the selected agent upon the nervous system, whereas in poison wounds of the character under consideration the virus is injected directly into the tissues and even into the veins and lymphatics. Here animal virus of unknown chemical constituency enters directly into the circulation, producing chemical changes in the blood and human tissues. It is not reasonable to expect that these effects can be neutralized by the attenuated remedy, hence the necessity for direct antidotal treatment as secured by alcohol, iodine, potassium and other agents discussed, of which alcohol is the chief. But after the primary antidotal effects of these agents have been accomplished it will then be found beneficial to administer *arsenicum*, *lachesis*, *kali permanganum*, *veratrum album*, *naja*, *baptisia*, *belladonna*, *stramonium* or other indicated remedy for secondary symptoms and conditions. Carbolic acid in the fourth or sixth attenuation is also an excellent agent, in severe systemic intoxication with quickly oncoming unconsciousness; the patient mutters, is delirious, the pulse is slow and vibrates feebly, the face is besotted, the eyes injected and breathing very much oppressed, the symptoms being not unlike those of profound systemic infection in scarlet fever or diphtheria. With these indications present this remedy, administered at intervals of from fifteen to thirty minutes over a period of several hours, is the most beneficial that can be employed.

Belladonna, *stramonium* and *hyoscyamus* are to be considered when there are intense cerebral excitement, delirium, nervous jactitations, suppression of urine and other symptoms belonging to these remedies.

Arsenicum, *veratrum album*, *camphora* and *carbo vegetabilis* will occasionally be useful, as indicated, in prostration and collapse, if this is witnessed from these injuries, while *secale*, *baptisia*, *rhux tox.*, *lachesis* and *naja* will be found serviceable in relieving special symptoms of languor, great debility, oppressed breathing, feeble heart action, impending

suffocation, hemorrhagic oozings and other concomitant symptoms that are likely to be present during the course of constitutional infection from serpent virus. Individual symptoms, as severe headache, pain in the back, strangury, pain about the joints, dyspnea, spasmodic stricture of the throat, even nausea and vomiting and the like, will have to be prescribed for symptomatically, in some cases over several weeks of time.

Secondary paralysis following upon serpent bites will be met by the remedies that are most useful in diphtheritic paralysis, as ammonia, gelsemium, plumbum, zincum, arsenicum, phosphorus, lachesis, cicuta, nux vomica and ignatia.

For the pain of serpent or insect bites, especially the latter, apis, ledum, cantharis, belladonna and chamomilla are often beneficial. If febrile action quickly ensues aconite, gelsemium or veratrum viride may be needed.

Vegetable Poisons.—The second class of wounds belongs to the warfare of savage tribes, especially those of South America and Africa. It is known that the North American Indians were in the habit of dipping the points of their arrows into a decoction composed of various animal and vegetable poisons prior to a raid, it being understood, however, that this was also part of a practice usually performed in connection with various incantations and superstitious rites. It is not unlikely that arrows and spears thus treated were capable of setting up septicemia, but these wounds are not to be classed in the category of poisoned wounds as are those produced by arrow and spear points dipped in especially poisonous decoctions for the purpose of producing the effect of the drugs entering into their composition. It was the practice of the South American Indians to use woorari for this purpose, its effect being to paralyze the motor nerves, causing early paralysis of the muscles of locomotion and respiration. The peculiar effects of strychnia and a decoction made from the upas tree are also produced by arrow or spear wounds when the injury is inflicted within an hour or even a day of the dipping of the spear or arrow-point into the decoction; but it is not considered necessary in this volume to elaborate upon this character of wound nor to more than refer to its treatment.

TREATMENT. If a patient is seen immediately after being wounded by a poisoned arrow, about the same course would be pursued as to constricting the member, cauterization of the wound, scarification and other attempts at local neutralization of the poison as in the bites of animals. Furthermore, the internal administration of alcohol, iodine and, perhaps, permanganate of potash will be demanded here as in wounds caused by animal poison. For the convulsions of strychnia poisoning it may be necessary to resort to chloroform, or perhaps to full doses of hydrate of chloral or bromide of potassium. The internal administration of nux vomica, ignatia, gelsemium or other homeopathic remedies should be useful for the secondary effects of poisons thus injected into the system.

Dissection Wounds.—This class of wounds was formerly supposed to be exceedingly dangerous to life and was much more common than now, their greater rarity in recent years being due in part to the care exercised in preparing corpses for dissection by the injection into the arteries and veins of antiseptic fluids, as arsenicum, mercuric bichloride or other chemical agent. It occasionally happens, however, that in the perform-

ance of an autopsy without previous preparation of the subject a surgeon or student is wounded and severe constitutional symptoms ensue. It was formerly considered that dissection wounds produced a course peculiarly their own, whereas it is now well understood that they run the general course of septicemia or pyemia, depending upon the nature of the poison, the quantity produced and the receptivity and impressionability of the person wounded.

PROPHYLAXIS. In the performance of operations upon patients suffering from erysipelas, gangrene, peritonitis or other malignant septic condition the surgeon should be especially careful in the use of the scalpel, scissors or other instrument not to inflict upon himself even slight injury. He should also take special pains in the preliminary preparation of his hands, which should be treated to the best-known antiseptic preparatory methods and which, during the operation, should be bathed as often as possible in a germicidal solution. In cases of unusual malignancy it is often desirable to anoint the hands, especially the fingers, with carbolyzed vaseline or other chemicalized unction in order to avert the absorption by the integument, through unobserved abrasions, of the tissue of septic material. It is also well to observe unusual care in promptly removing from the operative field all decomposing and septic material, to call into frequent requisition the bichloride or carbolic irrigating douche in permissible cases, and to resort to the free use of sterilized water during operations upon the abdomen. Throughout the whole operation it should be the aim to render the tissues operated upon as sterile as possible, and at the same time to so freely resort to germicidal solutions and dressings that the danger of infection will be reduced to the minimum.

SYMPTOMS. The symptoms and course of a dissection wound will depend in good part upon the malignancy of the poison. If the subject's tissues be in a reasonably firm and healthful condition the danger from slight abrasions is not unusually great, the symptoms in this case being slight stinging pain with local heat and swelling and perhaps a moderate degree of involvement of neighboring lymphatic vessels and glands. If, on the other hand, the death of the subject has been produced by one of the infectious fevers, or other malignant disease, and especially if the tissues operated upon are undergoing softening or mortification, the danger is greatly increased and here the suffering is much more intense. Within a few hours there is severe pain, pronounced heat, marked swelling at the site of the injury, with infiltration of surrounding tissues and general involvement of the glands and lymphatics of the neighborhood. There will also be severe rigors, intense headache, high fever, thirst, restlessness, even anguish, and if the sepsis that has been introduced be unusually virulent or considerable in quantity there quickly follows a diffuse cellular inflammation over a large area in the immediate neighborhood of the wound. In severest cases this becomes phlegmonous in character and is followed by sloughing, suppuration and even gangrene. The general symptoms and course of a case of this character are not unlike those of acute septicemia, whereas other cases present more the course of pyemia, with metastatic abscesses and a long tedious illness.

A primary indication of extreme malignancy in dissecting wounds is

the early formation at the site of the injury of vesicles or bullæ. These may be single or multiple and filled with opaque or transparent fluid or with bloody serum. The more malignant the poison the darker and larger the vesicles and bullæ.

In a certain proportion of cases of dissection wounds the symptoms and general course of the case are very like those belonging to a low grade of typhoid fever, differing somewhat from the typical course of septicemia or pyemia. The patient is prostrated, emaciation quickly following, the tongue becomes dry and hard, the lips and teeth are covered with sor-des and there are muttering delirium, diarrhea and a general sunken state of the system. In other cases the symptoms are intense but largely local. A finger or hand may swell to enormous size within a day or two after being wounded and take on a general erysipelatous appearance, constitutional symptoms not being over-pronounced, as a slight degree of malaise, with shivering sensations, with rise and fall of the temperature—the local condition causing the patient intense local suffering without severe systemic involvement.

TREATMENT. There is no specific treatment for dissection wounds, the successful management of this class of poisoned wounds belonging to the general treatment of septicemia or pyemia, for which the sections covering those subjects should be consulted. At the time of the infliction of the injury it is well to touch the wound with crude carbolic acid, the actual cautery, nitrate of silver or other caustic, and it will not be amiss to throw a ligature around the wounded member above the injury with a view to preventing the influx of poison into the circulation. Scarification or suction, or both, may also be practiced, and where it is known that the poison is unusually malignant hypodermic injections of carbolic acid, ammonia or permanganate of potash beneath the wound should be practiced, as in the bites of venomous serpents.

If the site of the injury is especially painful hot fomentations containing hamamelis, calendula, iodine or laudanum may be applied. For the subsequent sloughing and unhealthy conditions of dissection wounds the local use of antiseptic solutions and dressings as practiced in other surgical conditions should be observed.

MEDICATION. Remedies that will be found useful for the systemic state that follows upon dissection wounds are arsenicum, china, baptisia, hepar, rhus, carbolic acid, lachesis, mercurius, gelsemium, silicia and phosphorus. These and other remedies should be prescribed according to symptomatic indications. The Chapters on Septicemia and Pyemia may be consulted to advantage in this relation.

CHAPTER III.

INCISED, LACERATED, PUNCTURED AND CONTUSED WOUNDS.

Healing of Incised Wounds by Primary Union. — When a tissue is wounded there immediately occurs an oozing of blood from the incised structures, this taking place from all the vessels and capillaries that are severed. As the oozing begins coagulation also sets up, and if the two sides of the wound are accurately apposed—if no foreign substance is introduced—the exuded lymph agglutinates the surfaces, and if the wound be closed in by sterile dressing, all extraneous matter and germ life being excluded, healing by primary union, or first intention occurs in wounds of moderate size.

While it is usually explained that under these circumstances wound-healing occurs without inflammation, it is nevertheless a fact that no matter how clean-cut the injury, nor how minute the incision, nor how free the wound may be kept from septic material, there is yet a microscopic inflammatory process in every wound. This is due to the effect of the injury upon the sympathetic system, causing slowing of the circulation, stasis and a moderate degree of lymph-exudation. If, however, nothing impure is admitted to the wound and if all forms of animal life are excluded this mild degree of inflammation is non-productive of harm. A delicate layer of epithelium is soon spread out over the surface and within a few hours, or at most a day or two, this character of wound is reasonably safe from infection through the protection which has arisen from the gluing together of cut surfaces by the deposit of lymph spoken of and the early formation of the epithelial layer above it. The lymph which agglutinates the edges of the wound is quickly disposed of by being infiltrated with leucocytes and plasma-cells, which latter organize into fibrous tissue.

SYMPTOMS. The constitutional disturbances which attend healing by first intention are insignificant in slight wounds. There is a trifling degree of pain and slight febrile reaction in the immediate vicinity of the injury. The edges are red and inflamed and the sore is tender to the touch, but beyond these symptoms there is really nothing to give the patient discomfort.

In larger wounds, however, even where there is no sepsis in the case, a sharp, reactionary fever of from two to three degrees may be experienced, the patient suffering slight headache, apprehension and a feeling of tension or discomfort in the wound and perhaps trifling constitutional rigors. This is nothing more or less than the reactionary fever described in Section VI. Its cause is not clearly understood; in some instances seeming to be due to disturbances of the nervous equilibrium only, while in other cases, and perhaps in all, it is more or less influenced by the formation of a pyrogenous element, dependent in part upon the process necessary

to transform the blood-plasma into the fibrous structure forming the cicatrix.

Healing of Incised Wounds by Blood-Clot.—Another method of repair is that accomplished by the formation of a blood-clot in the wound. In this form of union there is exuded into the severed structures a larger amount of blood than can be taken care of, as in union by first intention, and a mold is formed over the clot which is penetrated by leucocytes and subsequently by plasma-cells. The process that goes on is very much like that occurring in primary union, but in this form of repair the blood-clot becomes organized, after which thin layers of epithelium are spread out from both lips of the wound, penetrating more or less deeply into the clot but not completely covering it. A crust forms above that portion that is not overlaid by epithelium and eventually peels off, showing a tender cicatrix beneath.

Healing by Granulation.—There is still another method of repair, that by granulation, with which it is necessary to be familiar. All the steps belonging to healing by primary union and healing by blood-clot—as an initial inflammatory action, the occupancy of the wound by blood-plasma and blood-clot and the early formation of epithelium—are observed in the first step of attempts at healing in wounds that are eventually closed by granulation. This process differs, however, in the fact that instead of the lymph and blood-clot organizing into the fibrous material and cicatrix that fill the gap and separated edges of the wound, the deposits undergo liquefaction, and instead of the inflammatory process ceasing when sufficient reactionary inflammation has been accomplished to unite the wound it goes on to a stage of destruction, with the result that normal tissues in the wound and at its edges are liquefied and thrown off—first as serum, then as liquefied serum and later as pus.

As the wound is cleared of its liquid secretions it will be observed that at its bottom and perhaps along the sides tiny granulations are formed, these gradually filling the wound and organizing into fibrous tissue. As the healing process goes on this contracts and thus the wound-area is decreased in size, in some cases quite a pronounced degree of shrinking occurring.

As in healing by first intention and by blood-clot so, also, in healing by granulation—a layer of epithelium begins and grows out from the surface, eventually covering the new tissue and further shrinking the area, so that under favorable circumstances even considerable-sized wounds eventually leave, in many instances, insignificant scars.

SYMPTOMS. This form of wound-repair is attended by pronounced constitutional disturbances, in many instances the degree of reactionary fever present causing no little apprehension. The symptoms produced are pronounced rigors, headache, anorexia, sometimes nausea and vomiting, and in nearly all cases a sharp rise in temperature during the first day or two. In some cases the temperature will register an advance of but two or three degrees while in others an advance of several degrees is noticed. In some cases it climbs as high as 104 to 105 degrees Fahrenheit. During this time the patient suffers all the inconveniences and discomforts belonging to fever, but, fortunately, if the case does well this degree of elevation lasts but a few hours or a day or two, at most, when

the temperature gradually subsides, perhaps irregularly, until the normal is regained.

This manifestation of fever should not be mistaken for sepsis or blood-poisoning. It is undoubtedly due to the liberation of pyrogenous material and the absorption of the chemical products dependent upon the formation of bacteria in the wound. After nature throws out a lymph-barrier in the bottom and sides of the wound to protect herself against the absorption of these foreign materials, and as this process is accomplished, the disturbances subside and the lymph that is exuded is formed into granulation masses which become organized into a fibrous product, to secure the closure of the gaping area by granulation.

It is but a step, however, from the process described to typical sapremia. If the wound be large and plentifully supplied with lymphatics there may be a sufficient amount of chemical decomposition and absorption to induce positive symptoms of septicemia (See Septicemia.)

In other cases nature may be equal to the primary emergencies of the case and succeed in warding off the state known as septic intoxication, only to gradually yield to the profound, though less violent, poisoning known as pyemia, which manifests itself by repeated rigors, intermittent rising and falling of temperature, general constitutional disturbances and the formation of metastatic abscesses in various organs and tissues of the body (See Pyemia.)

Other states that may supervene in connection with the repair of wounds are erysipelas, gangrene, tetanus, local sloughing, etc.

Treatment of Incised Wounds.—The primary thought with incised wounds is toward securing immediate and permanent apposition of the severed structures, it being highly important to secure healing by primary union in every case in which this is possible. The more snugly and firmly the tissues are apposed the greater the certainty of their healing by immediate union, with the result that systemic infection is rendered less likely and that ugly cicatrices are less apt to occur. Healing by primary union occurs much more quickly than healing by granulation, and there is also less likelihood of systemic disturbance from suppuration, pain and local irritation. Furthermore, there is less danger of such complications as erysipelas, gangrene, septicemia, pyemia, etc., if a wound be immediately closed and the protecting layer of epithelium be at once formed over the apposed severed tissues. Capillary hemorrhage is also more easily controlled by immediate apposing of the severed structures than by the application of dressings with compression upon an open wound. There is every reason, in fact, why in incised wounds it is desirable to secure their prompt closure and early healing.

SUTURES. This union is best accomplished, as a rule, by the application of sutures, though in slight incisions it may be sufficient to draw the edges of the wound together, securing their apposition by the use of surgeons' adhesive strips. However, it is always more surgical, even in slight incisions, to suture their edges together.

Before sutures are inserted all oozing should be checked, to prevent the formation of blood-clot in the gap, this necessitating "healing by blood-clot," unless, perchance, the clot should liquefy, when the wound would have to heal by granulation. Where there is a good deal of capillary oozing and it is not checked by pressure it is better not to wait for

its cessation but to bring the edges of the wound together and by snugly apposing them and applying pressure by aseptic dressings to secure its discontinuance.

Sutures are made of silk-worm gut, sheep-gut, kangaroo tendon horse-hair, cotton thread, silk thread and silver wire. Whichever of these is selected should be rendered sterile by being boiled in soda solution or exposed to a current of steam. If silk or silver be used it should be sub-

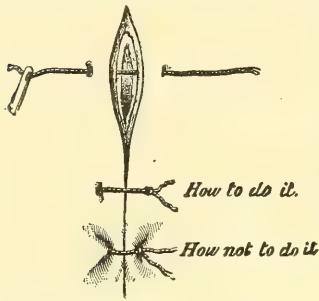


Fig. 981. Interrupted Suture. Before Tying—Properly Tied—Too Tightly Drawn.

jected to thorough disinfection by sterilization immediately before use, though silk that has been sterilized and subsequently preserved in absolute alcohol or in carbolic acid or sublimate solution is rendered sufficiently safe for general use. Animal membrane suture should be rendered sterile and subsequently preserved in alcohol, juniper oil, or other aseptic vehicle. Among other substances that have been used for sutures buck-skin, raw-hide, large blood vessels and intestinal fibre of various animals may be mentioned. The one most commonly used is ordinarily known as cat-gut, but it is really a product of the muscular coat of the small intestine of the domestic sheep. This is macerated and thoroughly disinfected, being subsequently immersed in carbolized oil and chromic acid. The latter is used especially to harden the tissue and prevent its too early absorption. The oil of the juniper-berry has been used for the same purpose, the suture being subsequently preserved in absolute alcohol. It is not necessary to enter into detail in this volume in relation to the mode of preparation of the different materials used for sutures. Those commonly prepared and on sale by reliable instrument houses are to be depended upon.

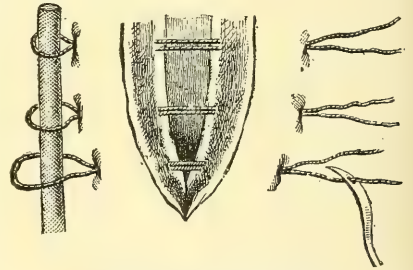


Fig. 982. Quill Suture.

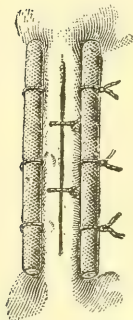


Fig. 983. Quill Suture. Wound Edges Apposed.

COAPTATION. Care should be exercised, no matter what form of suture is used, that the incised tissues be accurately apposed and the coapting sutures not too tightly drawn. Figure 981, from Moullin, illustrates the interrupted form of suture, the upper thread showing its introduction through the tissues prior to its being tied, the second suture illustrating its correct application, the third showing the tissues too tightly drawn. The latter is faulty in that it results in contraction and unsightly scarring, in many instances strangulation of the integument and even deeper tissues, with sloughing, being the result. The quill suture is shown in Figures 982 and 983. When this form is used a piece of quill, soft rubber catheter, bougie, rubber-tubing, or other similar material is passed through the loops of sutures that have been introduced double, these being drawn snugly around it, another piece being inserted between the free ends of the ligature on the opposite side of the wound, the knots being tied over it at points corresponding with the loop on the opposite side.

This suture is not as much in favor as in former years, though it is occasionally resorted to at the present time, especially where it is desirable to distribute the tension over a considerable area. Figure 984 illustrates the intestinal quilt suture, much in favor in intestinal operations. Figure 985 is illustrative of the button suture and Figure 986 shows the figure-of-eight suture applied over hare-lip pins, this kind having been formerly very much in vogue in connection with operations upon the lips and about the face. Figure 987 is illustrative of the glover's stitch, a continuous suture made after the fashion of the continuous seam used by

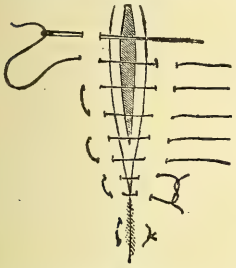


Fig. 984.
Intestinal Quilt Suture.

glovers. The method of application of this latter stitch is clearly shown in the cut. In the quilt suture (Fig. 984) the needle is carried through the two flaps of the wound and then back again, so that the loop is left on one side, the two ends on the other. This may be secured at once, or a suture may be carried in the same manner along the whole length of the wound, the depending loop being subsequently snipped with the scissors, thus giving practically

the interrupted suture. The button suture (Fig. 985) is made by passing a threaded needle through one of the buttonholes, through both lips of the wound and out through the buttonhole of the second button on the opposite side of the wound, back through the other buttonhole, again through the tissues and out of the remaining buttonhole of the proximal button. The needle is then withdrawn from the thread, or the latter is cut off, and the suture is tightly drawn and tied over the proximal button, the pressure being thus distributed over the area covered by the buttons instead of being limited to the tissue embraced in the knot. The figure-

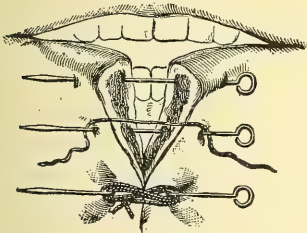


Fig. 986.
Figure-of-Eight Suture.

of-eight suture is shown in Figure 986 and necessitates the previous use of steel or silver pins, which are introduced about half an inch from the margins of the wound, passing obliquely downward through the thicknesses of the tissues on the one side of the wound and being made to enter and pass out of the

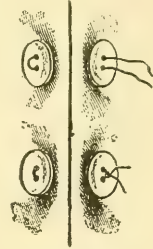


Fig. 985.
Button Sutures

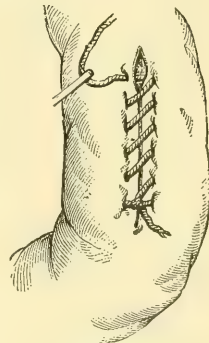


Fig. 987.
Glover's Suture.

structures on the other side at an equal distance, the mucous membrane not being included. The selected ligature is then passed around the pin in the form of a figure-of-eight and securely tied, the thread not having been inserted in the tissues at all.

NEEDLES. In sewing wounds of the intestines or other tissues where it is desirable to avoid leakage and to have the puncture made by the needle completely occupied by the suture-material the ordinary round sewing needle is used by preference. In ordinary integumentary wounds the slightly curved or quarter-curved needle with a flat surface or with

one surface convex and the other concave is used. The Hagedorn needle is a half curved needle with a sharp or sabre point, and possesses advantages for operations upon the perineum, but it makes too large a wound for integumentary sewing. As a matter of fact, it makes little difference what form of needle is used, providing it accomplishes the purpose of puncturing the tissues to a sufficient depth to secure a good purchase thereupon and is of sufficient calibre to carry the suture through the tissues without the use of undue force. The objection to many needles in common use is the smallness of the eye, making it difficult to thread them without loss of time that is often valuable.

Adhesive Strips.—Adhesive plasters are only of value in the treatment of wounds in supporting or taking the strain off sutures. They should not be relied upon to coapt the edges of wounds, but by being applied over the skin for some distance beyond the point of entrance and exit of a suture and being passed across the wound—the surface of which may be protected from the irritation of the plaster by protective lint, gauze or rubber—they will be of service in relieving the tension of the sutures and in thus preventing the wound from gaping between the stitches.

Medicated Dressings.—As a rule it is not desirable to medicate raw surfaces if close coaptation can be secured and the parts can be sufficiently protected from the atmosphere to insure them against infection. Since it has come to be understood that suppuration and other unhealthy processes occurring in connection with wounds are due to bacterial infection the practice obtains with most surgeons to dress all wounds with iodoform, aristol, salol, boracic acid or other absorbent dressing. It has long been an open question whether the freedom from suppuration in wounds thus treated is due to the germicidal action of the preparation used or to its absorbing properties only, it being understood that the drier a wound is kept the less likelihood there is of fermentation and liquefaction of its blood-plasma, or blood-clot. Experiments have shown, however, that where the various preparations of iodine are used there is evidently a chemical relation between the dressing and the tissues that proves of value in preventing bacterial fermentation. A recent application that is finding favor abroad is nosophen, an odorless, yellowish-gray powder, acid in character and insoluble in water, alcohol and acids, but easily soluble in ether. It is held that wounds covered with this preparation, of which the base is iodine, heal smoothly without any irritating effects from the drug and with moderate infiltration of the tissues. The influence of iodoform in retarding the formation of pus is too well known to require comment. Nosophen is held to be superior to iodoform in this relation, and possesses the additional advantage of being free from the odor of that drug. The homeopathic surgeon will prefer not to use any of these agents when possible to secure perfect asepsis and to so dress wounds that they are guaranteed immunity from infection, thus securing satisfactory results without the application of drug agents. On the other hand, the experience of leading surgeons of both continents goes to show that wounds that are treated immediately after suturing by the application of anti-bacterial preparations, as those named, and others, and that are subsequently protected by a free application of sterilized or antiseptic dressings, heal more kindly and certainly than where effort is made to get along without them. This question is still sub judice.

Lacerated Wounds.—Lacerated wounds are those in which the tissues have been torn and shredded, whether by machinery accident or other injury. Gunshot injuries are sometimes of lacerated nature, especially when caused by shell explosions or a spent grape-shot or cannon ball; these, however, are considered in the Section on Gunshot Surgery. It is sometimes difficult to clearly classify a lacerated wound, since there are oftentimes sharp incisions and extensive contusions in a wound properly coming under this classification. It is enough to say that all wounds that are irregular and jagged, in which the tissues are not clean-cut, but are torn or unevenly severed, are properly denominated lacerated wounds.

CAUSES. This class of wounds is caused by machinery accidents, blows from dull instruments, by railway accidents and sometimes by crushing injuries such as occur in stone quarries and mines from blasts from gun-powder or dynamite. In mill machinery a limb is sometimes fairly torn from the body by being caught in the belting or in parts of rapidly revolving machinery, injuries thus caused being typical illustrations of the lacerated type. In planing-mills, saw-mills, cotton-gins and various factories lacerated wounds are of common occurrence.

SYMPTOMS. The tissues are torn and ragged, sometimes shredded into long strips. The pain is less acute and intense, as a rule, than in incised wounds, but is more persistent. It is generally described to be of a dull, aching character, though if large trunks of nerves be exposed it may be more acute, even agonizing. Hemorrhage is less pronounced than in clean-cut wounds, the blood vessels being crushed and twisted and torn irregularly so that contraction and occlusion are observed in most cases, even in severe lacerations. There may be considerable hemorrhagic oozing, and violent hemorrhage is also occasionally witnessed. The local appearance of a large lacerated wound is most unsightly. If a member be torn from the body the integument is usually gloved off higher than the line of separation of the muscular structures, these protruding and being exposed for a distance of perhaps several inches. The muscles may be shredded, the tendons, blood vessels and nerves exposed for some distance, and not infrequently the soft structures are torn away at a point higher than the bone is severed—with the result that this protrudes from the stump, necessitating amputation several inches higher than would otherwise be necessary.

The shock of large lacerated wounds is sometimes very severe, but in other instances, the pain not being so intense and there not following the loss of blood that occurs in large incised wounds because of the bruising, contraction and occlusion of the blood vessels that occur, the degree of shock is comparatively insignificant. If large nerve trunks be exposed it may be very severe. In one instance occurring under the author's observation a strong young man lost his hand and forearm by having them caught by the saws and drawn into the machinery which separates the seed from the lint while feeding cotton into a gin. The ulnar nerve was exposed for a distance of several inches and was severely mutilated by the saws, the radial nerve being likewise injured. In this case the shock was most profound, though the hemorrhage was not over-severe. In another instance an arm was badly mutilated in a planing-mill, the nerves of the forearm being similarly exposed, yet the shock seemed insignificant nor was the suffering of the patient very pronounced.

RESULTS. Lacerated wounds are much more likely to slough than are incised and clean-cut injuries. In extensive lacerations it is difficult to properly appose the injured tissues, portions of which are usually more or less completely deprived of their nourishment, with the result that the process of separation of ragged portions is attended by suppuration, and, in severest cases, local gangrene is seen to occur. If large blood vessels are injured or if the blood-supply be extensively interfered with sphaceli are sloughed away and there is more or less dangerous systemic infection, unless special care be taken to establish free drainage and provide for thorough cleansing of the wounded tissues as necessary.

If gangrene sets in in a lacerated wound, especially if a large area of tissue be involved, it is likely to become diffuse and spread quickly into the surrounding structures with the result that life is endangered and amputation of the diseased member may become a necessity. In a case occurring in the author's practice the soft structures of the foot and ankle were extensively injured in a harvest-machine accident, and as a consequence traumatic gangrene quickly followed, necessitating amputation of the leg at its upper third. For more extended reference to diffuse or traumatic gangrene in connection with injuries the student is referred to the Chapters on Gangrene.

TREATMENT. Under old methods it was quite the rule in cases of extensive laceration of the soft structures of the limb, and more especially if the bone were involved in the injury, to perform immediate amputation, but under present methods of practice large lacerated wounds may now be successfully treated without resorting to the loss of a limb, even in cases that appear extreme. All ragged tissues should be carefully incised away, all extraneous matter in the wound should be carefully removed and washed out with sterilized water, torn nerves should be incised sufficiently well up in the wound as not to be caught in the cicatrices that form, while exposed tendons should be secured, or, if injured to considerable extent, should be severed and removed. No muscular tissue or integument that is supplied with sufficient nourishment to be able to live should be incised, it being the surgeon's aim always to preserve as much of the wounded tissue as possible. Muscular structures may be sutured together with sheep-gut and ragged portions of integument may be similarly treated. Tendons may be carefully apposed, and even torn nerves that are not destroyed for any considerable extent may also be apposed and sutured in like manner. By thoroughly irrigating large lacerated wounds with sterilized water or chemicalized antiseptic fluids until perfect cleanliness is secured they may be so repaired by needle and thread, and so dressed antiseptically subsequently as to unite and afford the wounded subject a fairly useful member.

In cleansing extensive lacerations it is believed that a warm bichloride solution should be used, this being followed by thorough irrigation with sterilized water. Permanganate of potash, carbolic acid, chlorine, calendula, Thiersch's solution or other suited agent should be used at all secondary dressings, and any of these may be judiciously used at the primary dressing of the wound. Under present methods the danger of extensive sloughing and gangrene is reduced to a minimum. By careful practice of asepsis and antiseptics the frequency of bad results in injuries of this nature has been largely reduced, one of the greatest achievements

in modern surgery lying in this ability to save injured members that have suffered extensive lacerations.

Amputation may be required—as in the case mentioned—when traumatic gangrene follows, from whatever cause. It may be that despite the surgeon's most careful efforts noxious materials are allowed to remain in the wound, or poison may have been introduced at the time the injury was inflicted and have been sufficiently absorbed to set up secondary putrefactive changes beyond the surgeon's control; and it should be remembered, also, that in spite of the utmost care in the application of the dressing and the subsequent attention to the wounds sepsis may be introduced later, or pyogenic bacteria may be developed therein with resulting sloughing and gangrenous sequences. It does not necessarily imply carelessness upon the part of the surgeon in extensive lacerations if these conditions obtain, but by the exercise of caution and the practice of antiseptics the danger of these or other complications is so greatly reduced that they are to-day not often witnessed.

Punctured Wounds.—Punctured wounds are those inflicted by the point of a sharp bayonet, spear or knife, or by a sharp-pointed, round instrument, the injury being small in so far as its integumentary extent is concerned, and, as the term implies, consisting of a puncture of the human tissues. In contradistinction to penetrating wounds it may be said that punctured wounds are more superficial and more after the nature of a stab injury, whereas a penetrating wound is one that penetrates deeply into the tissues or internal organs, the term usually being applied to injuries of this nature inflicted by bullets and like missiles. Perhaps the most common form of punctured wound met with in general practice is that inflicted by the domestic needle, or other similar small, sharp, round instrument, as a shoemaker's awl, the butcher's steel, etc. Bayonet wounds and punched wounds inflicted by the sabre in warfare also go under the head of punctured wounds, and the wounds of arrows, spears and other weapons of this character apply also to this classification. Some authors treat of the bites of dogs and other animals possessing sharp, round teeth as punctured wounds, but these more properly belong to the class described as lacerated wounds, since the tissues are almost always torn as well as punctured.

SYMPTOMS. Punctured wounds are usually acutely painful, even a small instrument often causing severe suffering, especially if its point be broken off in the tissues. The deeper the puncture the greater the pain, as a rule, and if the instrument inflicting the injury is not perfectly clean there is also considerable danger of sepsis from this class of wound, it being easier to properly cleanse and protect incised wounds and even severely lacerated tissues from sepsis because of the better drainage and more thorough cleansing permissible in these varieties of injury. Swelling is another symptom belonging to punctured wounds. In many instances the tissues are rendered very tense because of its extent. The end of a needle or other small instrument broken off in the tissues often causes severe pain and swelling, out of all proportion to the magnitude of the implement inflicting the injury.

The symptoms and secondary effects of bayonet, arrow and sabre wounds are sufficiently treated of in the Section on Gunshot Surgery, and

penetrating wounds are also so thoroughly reviewed in that section that further consideration in this relation is not necessary.

TREATMENT. Punctured wounds require no special treatment, unless the instrument inflicting the injury be broken off, or carry infection with it, in which event it may be necessary to enlarge the wound by the use of a scalpel, to remove any foreign substance that may be in the tissues and thoroughly irrigate and otherwise cleanse it of extraneous and septic matter. The local use of soothing applications, as hamamelis, calendula, hot water, arnicated lotion, laudanum or other medicament may be required in special cases. If free incision and drainage has been practiced antiseptic dressings should be subsequently employed.

For the pain or inflammation that quickly follows in many cases aconite or belladonna will be indicated. Arnica is beneficial whether the tissues are bruised or not if they become swollen, engorged or sensitive to the touch, as is likely to be the case. If local edema be pronounced and the integument at the site of the injury is tense, shiny and hot apis may be used to advantage. If a nerve be injured in the puncture hypericum may be prescribed to advantage. Hot fomentations, as hops, slippery elm, linseed meal and other like fomentations will be found helpful in special cases.

In a general way the treatment and medication of punctured wounds is that of incised wounds.

Contused Wounds.—A very common type of wound is that formed by contusion of the tissues by bruising or crushing injuries that do not altogether destroy the integument of the structures beneath, but that bruise or contuse them to that extent that severe ecchymosis, swelling and infiltrations are observed. These are caused by falls, blows, or similar injuries and are of greater or less extent, depending upon the nature of the cause. Severe contusions may crush considerable areas of tissue, with resulting sloughing or gangrene, without extensive abrasion of the integument or incision thereof.

SYMPTOMS. The part bruised becomes dark red in color and eventually bluish, and, in some cases, of variegated hue, representing an admixture of blue, red, black, purple and yellow. There occurs an infiltration of lymph into the injured tissues, blood settles in the capillaries and subcutaneous structures and swelling, puffiness, distension, even doughiness, follow. Contusions are more or less painful, depending upon their extent and the nature of the tissues bruised. There is local heat, and in some instances a sharp degree of inflammatory action is witnessed.

TREATMENT. When first seen contusions may be quickly relieved and their symptoms and course modified by the application of cold in some cases, of heat in others. Local sprains and bruises of inferior magnitude are best met by a free application of cold, while severe sprains and large areas of contusion are more quickly relieved, as a rule, by applications of heat.

Remedies that will be required are arnica, especially in severe bruises combined with sprains, both local and internal, it being remembered that the application of the tincture or a decoction of arnica is apt to be attended by erysipelatous inflammation. Hamamelis is also an excellent remedy for contusions, sprains, wrenches and similar injuries as a local application. Internally it is also of value, where there is a good deal of hemorrhagic

infiltration. Should vesication and other erysipelatous complications follow upon a bruise, belladonna, apis, baptisia, rhus and perhaps other remedies may be used to advantage. The lameness and pain that attend upon injuries of this nature are in themselves likely to encourage quiet and rest upon the part of the patient. In special cases it is necessary for prompt recovery from extensive contusions that absolute rest of the injured member be secured. In the case of large contusions it would be better to use local applications and dry antiseptic dressings, comfortably bandaging the injured part over a period of several hours or days, as required.

Medication in Wounds.—The medicines required in the treatment of wounds will vary greatly, the symptoms presented usually governing their administration; often, however, the character of tissue injured will be the guide to their use. It is usually best to give careful study to the symptomatology of a given case, depending upon the symptoms for the selection of the right remedy, no matter what the nature of the injury, since constitutional peculiarities are always a factor in enabling the surgeon to make a selection of a remedy in a given case. For an incised wound of a joint if it is painful when touched bryonia or pulsatilla may be the remedy indicated, the constitutional peculiarities indicating which one would be suitable in a given case. When the tendons and synovial membranes are injured rhus and arnica are valuable. In incised wounds inflicted with instruments, like razors or other very sharp-edged tools or knives, staphisagria is the remedy, to be followed later by such other medicines as may be indicated by the presenting symptoms, tissues incised and constitutional indications.

When the glands are injured the remedies usually required are iodum and kali, and when the periosteum is inflamed ruta is a suitable medicine. In contused wounds arnica is the chief remedy. After the wounds of surgical operations aconite is almost always indicated, particularly if there be much vascular excitement and serious disturbances of an inflammatory nature with high fever.

Staphisagria is highly recommended in incised wounds, particularly when occurring in tuberculous subjects, and is a remedy of prime value in wounds of the abdominal viscera.

Ledum is indicated in punctured wounds, and when there is general chilliness and coldness of the body, with anxiety and restlessness. In contusions arnica can be given internally and after antiseptic cleansing of a contused wound a 1 to 10 or 1 to 20 solution of arnica in water that has been boiled and reduced to a temperature of 105 degrees to 110 degrees Fahrenheit may be applied as a wash before the application of the final dressings to the wound. It is indicated in all wounds made by dull instruments when the tissues are torn, with more or less contusion of substance. It should always be given in those cases where there is much pain in the contused part, particularly when it is of a dull, tingling nature. It is also indicated in wounds from falls and in many cases of wounds from surgical operations, as in general painfulness and soreness of the periosteum of the bones after a wound or injury, particularly when accompanied by excessive sensitiveness of the mind. In some cases after the use of dilute arnica aggravations of pain will be noticed and occasionally some of the pathogenetic effects of the drug will be produced. In such

cases calendula, used in the same way and strength as advised for arnica, will be the better remedy to use locally in future dressings and should replace arnica internally from the moment of any noted aggravation of pain from the use of the latter.

In open contused wounds with fracture of bone accompanying the same symphytum is especially useful. When the ligaments and tendons are implicated rhus tox. is preferable to arnica for internal and external use. When in a contused and lacerated wound there is much sloughing of tissue china officinalis should be prescribed, particularly if accompanied by a feeling of general weakness or painful weariness in the joints, with pressure as if of a load on them.

When, after a contused or lacerated wound, the circulation is very feeble in parts and the patient's strength sinks rapidly arsenicum or carbo vegetabilis must be given. Arsenicum is particularly applicable when the tissues are more or less edematous, with thin bloody exudation; also in wounds accompanied by excessive debility, or in those wounds occurring in patients suffering from tuberculosis, particularly of the skin. The indications which point to carbo vegetabilis, besides weakness in the parts wounded and feeble circulation in the neighboring tissues, would be fetid odor or fetid night-sweats and great chilliness during the day time. In many of these cases, when reaction has set in but recovery is slow and tedious, mercurius solubilis and hepar sulphur will be valuable remedies, to be followed later on by silicia or sulphur.

When the periosteum is injured, ruta, mezereum or phosphoric acid should be studied and their applicability to a given case determined.

Calendula is indicated in most lacerated wounds. It may be given internally and applied externally to the lacerated wound. The proper method of its application externally is to use a solution of 1 to 10 to 1 to 30 in water that has been previously boiled and its heat reduced to a temperature of 110 to 115 degrees Fahr. by adding cold boiled water. The calendula thus mixed is to be applied to the lacerated wound after the use of the disinfecting sublimate solution. This serves a double purpose. It washes out of the deeper recesses of the wound any excess of antiseptic fluid that might otherwise remain and produce poisonous symptoms, and at the same time gives the benefit of the local application of the calendula to the wounded parts and its textural and local remedial effect.

When arnica is used as a local application, or, indeed, any other medicine is used as a local application to any wound surface the same rule and method of application should be observed in its use.

The dosage will, of course, vary according to the strength and power of the medicine used, varying perhaps from 1-10 to 1-30 for arnica or calendula to from 1-100 to 1-500 for rhus tox. and ledum. Calendula thus applied seems to exercise a favorable influence over granulating surfaces, inducing healthy cicatrization. After the application of calendula as indicated to the lacerated wound and after its administration internally it should be followed by hepar sulphur, silicia or sulphur, as may be indicated by the symptoms. In some cases with much nervousness and excitement and excessive restlessness and tossing about chamomilla must be given, its quieting effect being often most happy. When with the symptoms last enumerated there is high fever with, perhaps, delirium aconite, belladonna or hyoscyamus should then be given. Later on should much

weakness ensue, with thirst, hot, dry skin and unhealthy appearance of the wound, arsenicum is the indicated remedy, possibly to be followed by carbo vegetabilis, lachesis or china, according to the symptoms presented.

In punctured wounds ledum is particularly recommended, the symptoms of coldness during fever being one indicating its necessity. In other cases of fever accompanying a punctured wound arnica and aconite are often required, to be followed later on by rhus, ruta or bryonia. Rhus tox. is particularly indicated in all cases when there is injury of the tendons and muscular tissues. In many of these wound-injuries it is a better remedy locally applied than arnica. It should be used in solution of the strength 1-100 to 1-500 and should also be given internally. Should the tissues become gangrenous or the circulation in the neighborhood become interfered with china and arsenicum may be required. If there is excessive suppuration hepar sulphur may be required, while in other cases silicia may be better. Chamomilla is indicated when there are restlessness and uneasiness excited by emotion, and when there is severe local pain.

Calendula is not only a useful remedy in the local treatment of wounds but it is a useful remedy for the pain and tension that follow. its best effects being obtained when it is administered in the medium, thirtieth or sixtieth attenuations. It is doubtful if calendula has even moderate germicidal effect, recent experiments by Macdonald going to show that it is not a reliable germicidal agent. It is probable, therefore, that its curative effects are because of its specific relation to muscular and cutaneous structures. Too much reliance must not be placed upon this drug, either locally or internally applied, since over-confidence in it has resulted in more than one case of secondary suppurative process. The succus calendula is the best form in which to use the marigold.

Besides the remedies mentioned above for gangrenous states of wounded structures lachesis, baptisia, secale, carbo vegetabilis, carbo animalis, croton, and iodine may be studied to advantage. Given, however, clean, aseptic wounds, there should be no gangrene from local infection in any wound.

SECTION XXXII. MINOR SURGERY.

CHAPTER I. BANDAGING.

Import.—A complete knowledge of the art of bandaging is essential to the success not only of every surgeon but also of every physician. Skill in this branch of professional work is only to be obtained by a proper conception of the purpose which the bandage is intended to serve, and also by constant practice and observation of results.

OBJECTS. The purposes which a bandage serves are first, retention of dressings; second, equable compression; third, immobilization.

MATERIAL. The material usually employed for the roller bandage is unbleached muslin, because it is strong and at the same time inexpensive. Other materials, such as cheese-cloth, rubber or flannel, are used to serve special purposes.

Roller Bandage.—The roller bandage is usually applied from the distal toward the proximal extremity of the part. It should be applied rapidly with equal compression of each turn of the roller and should not be applied too lightly.

The extremities of the fingers and toes should project beyond the bandage so that the circulation of the part may be constantly observed.

The rolling of the bandage may be accomplished either by the bandage roller or by hand. Very useful machines for this purpose are represented in Fig. 988.

The advantage of the bandage roller is in the saving of time and in the firmness and evenness of the bandage. They may be rolled by hand as follows: Place the terminal end of the bandage upon the thigh and double it five or six times upon itself to form an axis around which the remaining part of the bandage may be rolled. Then roll it between the hand and thigh a few times until it becomes sufficiently firm to be held between the thumb and finger of the left hand without yielding. Then allow the body of the bandage to run over the right forefinger, seizing it firmly between this finger and the thumb so as to make traction. The cylinder is then revolved by means of the last three fingers of the hand

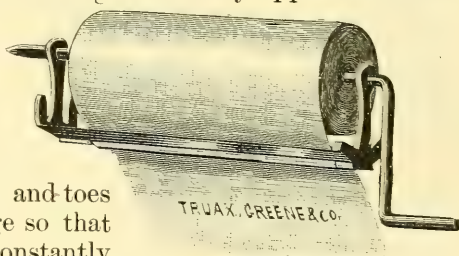


Fig. 988.
Bandage Roller.

in which it is held. At the same time the thumb and finger holding the body of the roller should be made to revolve partially around the cylinder. By this means the roller may be very quickly and neatly made.

CLASSIFICATION. Bandages are simple or compound as they are composed of one or more pieces.

A simple bandage rolled from each extremity toward the centre is called a double-headed roller.

The part of the roller first applied is called the initial extremity, the last applied the terminal extremity, and the portion between the extremities is called the body.

SIZES. Bandages should vary in length and width according to the part to which they are to be applied.

The following list comprises those most frequently used:

A bandage one inch wide and three yards long for bandaging the hands, fingers and toes; two inches wide and six yards long for the head and extremities in children; two and a half inches wide and seven yards long for bandaging the extremities in adults—a roll of this size is the one most generally used—a bandage three inches wide and nine yards long for bandaging the thigh, groin and trunk; four inches wide and ten yards long for bandaging the trunk.

POSITION OF LIMB. The limb to be bandaged should occupy the same position of flexion or extension during the application of the bandage that it is to remain in afterwards.

METHOD OF APPLICATION. The external surface of the initial extremity of the roller is to be placed upon the surface to be bandaged, is pressed firmly to the part with the fingers of the left hand; the right hand grasps the roller head tightly and carries it firmly around the part as far as possible. Then the roller head is grasped with the left hand, the right compressing the initial end and the turn over-lapping the initial turn is finished completely or partially as desired.

REMOVAL. In removing a bandage the folds should be carefully gathered up in a loose mass as the bandage is unwound, the mass being rapidly transferred from one hand to the other, thus facilitating its removal.

Varieties.—**CIRCULAR BANDAGE.** This consists of a few circular turns, each turn covering accurately the preceding turn, until the desired number of turns are made or the necessary compression secured. The bandage is then torn across the end, neatly folded in and secured by inserting a pin with the head toward the free extremity of the bandage.

SPIRAL-BANDAGE. In the spiral bandage the turns are carried around the part in an oblique direction, each turn over-lapping a portion of the preceding one, one-third or one-half.

SPIRAL-REVERSE BANDAGE. This is a spiral bandage but differs from the ordinary spiral bandage in having its turns folded back as it ascends a limb, the diameter of which gradually increases.

The reverses are made as follows: After fixing the initial extremity of the roller, as the limb increases in diameter the bandage is carried off a little obliquely to the axis of the limb to from four to six inches, the index finger or thumb of the disengaged hand being placed upon the body of the bandage to keep it securely in place upon the limb.

The hand holding the roller is carried a little toward the limb to

slacken the bandage from extreme supination to pronation and the reverse is made. It should be complete before the bandage is carried around the limb, and when it has been completed the bandage may be slightly tightened so as to conform accurately to the limb.

To make reverses neatly and to have them in line requires skill and practice. The best bandage for the leg is composed of alternate circular and reverse turns.

SPICA BANDAGE. In the spica bandage the turns of the roller cross each other in the form of the Greek letter Cambda and leave the previous turn about one-third uncovered.

This bandage is especially serviceable as a means of retaining surgical dressings upon particular portions of the surface of the body, such as the shoulder, groin or foot.

FIGURE-OF-EIGHT BANDAGE. This variety receives its name from the turns being applied so as to form the figure eight. This is one of the neatest and most useful of bandages. It is applicable to joints or other parts requiring firm and perfectly uniform pressure.

RECURRENT BANDAGE. This bandage is usually employed in the dressing of stumps after amputation.

Application. The initial end of the roller is placed on the limb three or four inches above the extremity of the stump and secured by three or four circular turns. On reaching the middle of the under portion of the limb the roller is reversed in order to conduct it over the end of the stump to the upper surface to about four inches above the extremity. The reverses are held with the fingers of the left hand until the entire stump is covered. Then they are secured by spiral reverse turns and are continued two or three inches above the part of the bandage first applied.

Compound Bandage.—This generally consists of two or more bands united so as to form a somewhat complicated means of retaining dressings; care should be taken to have them properly arranged that they may adapt themselves perfectly to the part they are intended to cover.

VARIETIES. The varieties of this form of bandage include the “T” and the invaginated bandages, slings, suspensories and laced bandages.

SINGLE “T” BANDAGE. The single “T” bandage consists of a horizontal band to which is attached, about its centre, another having a vertical direction. The horizontal piece should be about twice the length of the vertical piece. The single “T” bandage may be used to retain dressings of the head, the horizontal piece being passed around the head from the occiput to the forehead, the vertical piece being passed over the head and secured to the horizontal piece, the shape and width of the two pieces being varied according to the indications.

In applying dressings to the anal region or perineum or in securing a catheter the single “T” bandage will be found most useful. For this purpose the body of the bandage is placed over the spine just above the pelvis, and the horizontal portion is tied around the abdomen. The free extremity is split into two tails for about two-thirds of its length, and is carried over the anal region and brought up between the thighs, the terminal strips passing one on each side of the scrotum and being secured to the horizontal strip in front.



Figure 1. Of Angle of Jaw.



Figure 4. Gauntlet Bandage.

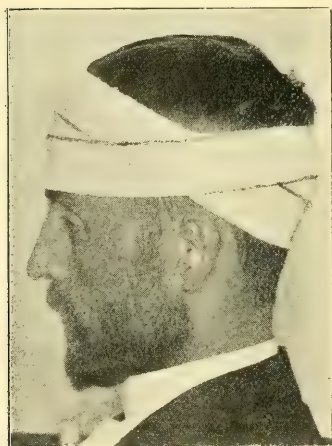


Figure 2. Occipito-Frontal.



Figure 5. Spiral Bandage of Thumb.

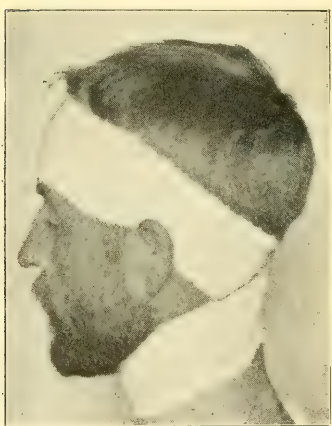


Figure 3. Of Head and Neck.

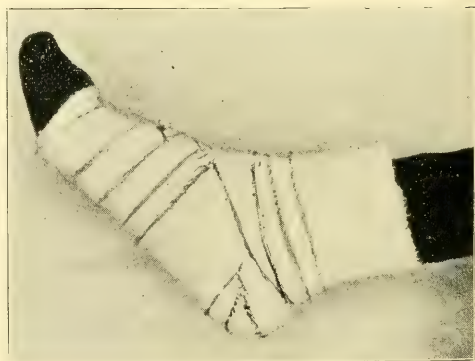


Figure 6. Of Foot and Heel.

DOUBLE "T" OF THE CHEST. A horizontal piece of muslin ten or twelve inches in width encircles the chest. Vertical strips two inches in width are attached to the superior border of the horizontal portion at the back, pass over the shoulders and are secured with safety pins to the anterior surface.

DOUBLE "T" OF THE ABDOMEN. A horizontal piece of muslin six to seven inches wide encircles the abdomen and at the lower border and posterior surface are attached two narrow bands one to two inches wide and half a yard long. The bands are to pass obliquely beneath the perineum, to cross each other at the place where the dressing has been applied, and to be fastened near the crest of the ilium.

COMPOUND "T" OF THE GROIN. This consists of a triangular piece of muslin five inches wide at the base and ten inches long. To its base is sewed a band two yards in length, to the apex another three-quarters of a yard long. The triangle is placed on the groin with its apex pointing downward, the superior band passes around the waist, tying the triangular portion, being then carried in front, and the vertical band being brought down between the thigh and scrotum, continuing the band over the outside of the thigh to be attached to the transverse portion. This makes a neat bandage for retaining dressings upon the groin in the treatment of buboes, or after operating for hernia.

DOUBLE "T" BANDAGE OF THE BUTTOCK. This form consists of a roller two yards long and three inches wide and two vertical bands, each three-quarters of a yard long and two inches in width, stitched to the former at the proper distance apart and at about one quarter its length from one extremity. The horizontal band is placed on the back of the pelvis so that the vertical strips may be conveniently and smoothly carried under the perineum and fastened to the horizontal band in front.

For retaining dressings of the perineum, anus and vagina, in cases of piles, prolapsus ani and fistula, this is a useful bandage.

"T" BANDAGE OF THE HAND. This is composed of two strips of bandage each a yard long by one inch wide, one of which is sewed to the other in the form of a "T." The horizontal portion of the bandage is placed on the back or front of the wrist, according to which side of the hand the dressing is to be retained, and the vertical roller carried over the inter-digital space of the first and middle finger to reach the wrist again, where it is fastened by a revolution of the transverse hand, the vertical piece being reflected over the second inter-digital space, and so on until the bandage is complete.

"T" OF THE HEAD AND EAR. This variety requires, first, a bandage from two to four inches wide and one yard in length. At right angles to this bandage, at a distance of ten or twelve inches from one end, there should be stitched another bandage two inches wide and two and a half yards in length, leaving one of its ends projecting some sixteen or eighteen inches beyond the first or widest portion. The point of juncture of the bandages is placed over the right temporal region—if this be the one involved—in such a manner that the widest portion of the bandage shall be perpendicular, as regards the head. Then the long end of this wide portion of the bandage is carried down under the chin and up on the other side to the top of the head, then pinning it to the short end, it is brought perpendicularly upwards from the temporal region. The longer

and narrower portion of the bandage is now to be carried horizontally about the head, the long end confining the short one by successive horizontal courses until it is finished. It is used in dressing the temporal, parotoid and thyroid regions.

Head.—**RECURRENT BANDAGE OF THE HEAD.** The initial extremity of the roller is placed upon the lower part of the forehead and the bandage is carried twice around the head from the forehead to the occiput to secure it. When the bandage is brought back to the median line of the forehead it is reversed and the turn is held by the finger of the left hand, while the roller is carried over the top of the head along the sagittal suture to a point just below the occipital protuberance; here it is reversed again and the reversed turn is held by an assistant while the roller is carried back to the forehead in an elliptical course, each turn covering in two-thirds of the preceding turn. These turns are repeated with successive reverses at the forehead and occiput until one side of the head is completely covered in, and when this is accomplished a circular turn is made from the forehead to the occiput to hold the reverses in place.

The opposite side of the head is next covered in by the elliptical reversed turns made in the same manner, and when this has been accomplished two or three circular turns are carried around the head from the forehead to the occiput to fix the previous turns. Pins should be applied to the forehead and occiput at the points where the reversed turns concentrate.

This is one of the neatest of head bandages for retaining dressings to the vault of the cranium in the treatment of wounds of the scalp, holding dressings to fractures and after the operation of trephining. The roller should be two inches in width and eight yards in length.

TRANSVERSE RECURRENT OF THE HEAD. The initial extremity of the roller is placed upon the lower part of the forehead and the bandage is placed twice around the head from the forehead to the occiput to secure it. The head is then covered in by transverse turns of the bandage, the first turn, starting from a point behind the ear on one side, is carried below the occiput to a corresponding point behind the opposite ear, and ascending transverse turns are then made and carried over the head, each turn covering in about two thirds of the preceding turn until the forehead is reached, when two or three circular turns are carried around the head from the forehead to the occiput to fix the recurrent turns. Pins should be inserted at the point of starting of the reversed turns behind the ears and at the occiput and forehead. This is used for the same purpose as the recurrent bandage of the head. The roller should be two inches in width and six yards in length.

HEAD AND NECK BANDAGE. The initial extremity of the roller is placed upon the forehead and carried backward just above the ear to the occiput and is then brought forward around the opposite side of the head to the point of starting. Two of these circular turns are made to fix the bandage, and when it is carried back to the occiput it is allowed to drop down slightly upon the neck and is then carried around the neck, the turns around the head alternating with the neck turns until a sufficient number of these have been applied, when the extremity of the bandage is secured by a pin at the point of crossing of the turns at the

back of the head. It is used for retaining dressings to the anterior or posterior portion of the neck or to the region of the occiput.

Care should be taken to avoid too much pressure by the turns around the neck, which would make it uncomfortable for the patient and would interfere with respiration. The roller should be two inches in width by four yards in length.

CROSSED BANDAGE OF BOTH EYES. The initial extremity of the roller is placed upon the forehead and secured by two circular turns of the bandage, passing around the head from the forehead to the occiput; the roller is then carried downward behind the occiput and brought forward below the ear to the upper portion of the cheek; it is then carried upward to the junction of the nose with the forehead and conducted over the parietal protuberance to the occiput. A circular turn is now made around the head from the occiput to the forehead, and the roller is carried from the occiput over the parietal protuberance of the opposite side forward to the junction of the nose with the forehead, then downward over the eye and outer portion of the cheek below the ear and back to the occiput. A circular turn around the head is next made, and this is followed by a repetition of the previous turns, ascending over one eye, descending over the other, each turn alternating with a circular turn around the head. These turns are repeated until both eyes are covered in, and the bandage is finished by making a circular turn around the head, the extremity being secured by a pin. Both ears can be left uncovered or covered.

It is used to apply dressings to both eyes, or to make pressure. The size of the roller should be two inches in width by six yards in length.

OCCIPITO-FRONTAL BANDAGE. The initial extremity of the bandage is laced upon the forehead and a circular turn is made around the forehead and occiput to fix it. A circular turn is then made, passing around the head from a point below the occiput to a point just above the forehead; the next circular turn is made around the head, ascending posteriorly and descending anteriorly, and after a sufficient number of turns have been made to cover in the front and back of the head the end of the bandage is secured with a pin.

It is used in securing dressings to the forehead and the anterior and posterior portions of the scalp. The bandage should be two inches in width by four yards in length.

Hand.—SPIRAL BANDAGE OF THE FINGER. The initial extremity of the roller is secured by two or three turns around the wrist, the bandage is then carried obliquely across the back of the hand to the base of the finger to be covered in, and then to its tip by oblique turns. A circular turn is then made and the finger is covered by ascending spiral or spiral reversed turns until its base is reached. The bandage is then carried obliquely across the back of the hand and finished by one or two circular turns around the wrist. The extremity may be pinned or may be split into two tails, which are tied around the wrist.

It is used to retain dressings upon the fingers and to secure splints in the treatment of fractures or dislocations of the phalanges. The roller is one inch in width by one and a half yards in length.

GAUNTLET BANDAGE. The initial extremity of the roller is fixed at the wrist by one or two circular turns of the bandage. It is then carried

to the tip of the thumb by an oblique turn of the roller, and this is covered in by spiral or spiral reversed turns to the metacarpo-phalangeal articulations; the roller is then carried back to the wrist and a circular turn is made around it, when the bandage is carried down to the tip of the next finger by an oblique turn, which is covered in a similar manner. When all the fingers have been covered in the bandage is finished by circular turns around the hand and wrist. It is used in case of wounds or fractures. In the treatment of burns of the fingers to prevent the apposed ulcerated surfaces from adhering each finger is put in a separate dressing and a dressing applied over the whole with a few recurrent and spiral turns of a wide roller, this dressing being less painful to the patient.

The roller should be one inch in width and three yards long.

SPICA BANDAGE OF THE THUMB. The initial extremity of the roller is placed upon the wrist and fixed by two circular turns, then carried obliquely over the dorsal surface of the thumb to its distal extremity; next a circular or spiral turn is made around the thumb, and the bandage is carried upward over the back of the thumb to the wrist, around which a circular turn should be made. The roller is next carried around the thumb and wrist, making figure-of-eight turns, each turn over-lapping the preceding one two-thirds as it ascends the thumb, and each figure-of-eight turn alternating with a circular turn about the wrist. These turns are repeated until the thumb is completely covered in with spica turns, and the bandage is finished by a circular turn around the wrist. It is used to retain dressings to the dorsal surface of the thumb in the application of splints in dressing fractures or dislocation of the bones of the thumb. The roller is one inch in width and three yards in length.

Arm.—REVERSED SPIRAL BANDAGE OF THE UPPER EXTREMITY. Having covered the hand by the gauntlet bandage, one or two circular turns are made around the wrist to secure the end of the bandage and it is then carried up the forearm by spiral and spiral-reversed turns until the elbow is reached. The elbow joint is covered with the figure-of-eight if the elbow is to be flexed; otherwise the simple spiral turns may be used with the reverse, continuing the bandage up to the axilla with spiral reversed turns. It is used very extensively in applying dressings of fractures, dislocations, and in the treatment of varicose veins, aneurism, etc. The roller is two and a half inches wide and ten yards long.

Elbow.—FIGURE-OF-EIGHT BANDAGE OF THE ELBOW. The initial extremity of the bandage is placed upon the forearm a little below the elbow-joint, and secured by one or two circular turns, then carried by an oblique turn across the flexure surface of the elbow-joint, and passed around the arm a few inches above the elbow; a circular turn is then made and the bandage is next carried across the flexure surface of the elbow and passed around the forearm. These turns are repeated, the turns from the forearm ascending and those from the arm descending, each set of turns crossing in the flexor of the elbow until it is covered in, a final turn being passed circularly around the elbow-joint. Its use is to hold dressings or splints to the elbow-joint and to hold a compress upon the wound from venesection at the elbow, etc. The bandage is one and a half inches in width and four and a half yards in length.

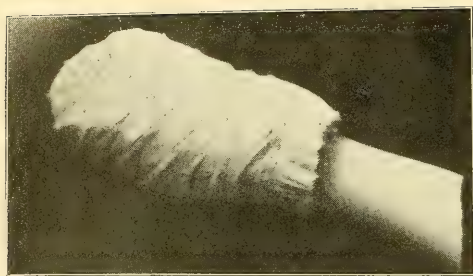


Figure 1. Spica of Hand.



Figure 2. "Figure-of-Eight."



Figure 3. Recurrent of Stump.



Figure 4. Spica of Arm.



Figure 5. Spiral of Finger.

PLATE LI, B.—Bandages.—SMITH.

Shoulder.—**SPICA BANDAGE OF THE SHOULDER.** The initial extremity of the roller is placed upon the arm near the axillary fold by one or two circular turns; the bandage should be passed under the axilla and obliquely over the shoulder to the base of the neck and then downward across the front of the chest to the axilla of the opposite side; from the axilla the roller is carried over the back of the chest to the base of the neck so as to cross the first turn at this point, and is then carried to the axilla and through this, then back to the neck, the turns descending toward the shoulder. These turns, taking the same course, are repeated, each one over-lapping two thirds of the previous one until the shoulder is covered in and the circular turn around the arm is reached, at which point the extremity is secured by a pin. It is used to hold dressings to the shoulder, to retain the shoulder-cap in the treatment of a fracture of the upper portion of the humerus and to hold dressings to the axilla. The roller is two and a half inches in width by eight yards in length.

VELPEAU'S BANDAGE. The hand of the injured side is placed upon the opposite shoulder and the initial end of the bandage under the axilla of the sound side, the roller is carried diagonally up across the back to the top of the injured shoulder, then down across the clavicle, and over the front and outside of the injured arm and under the elbow. Then it is carried diagonally up across the chest, to and beneath the axilla of the sound side. This turn should be repeated to fix the initial extremity of the bandage. The second turn is completed, the roller carried transversely around the thorax, passed over the flexed elbow of the affected side, from this point to the axilla and through this to the back. From here the roller is carried over the shoulder and down the outer and posterior surface of the arm, behind the elbow and obliquely across the front of the chest, through the axilla to the back, and, passing transversely across the back of the chest to the elbow, which it encircles, it then passes to the axilla. These alternating turns are repeated until the arm and forearm are bound firmly to the side of the chest. The vertical turns over the shoulder—each turn covering in two-thirds of the previous turn and ascending from the point of the shoulder toward the neck and from the posterior surface of the arm toward the elbow—are applied until the point of the elbow is reached. The transverse rolls passing around the chest and arm are so applied that they ascend from the point of the elbow toward the shoulder, each turn covering in one-third of the previous one, the last turn passing transversely around the shoulder and chest, covering the wrist. It is used in the treatment of fractures of the clavicle and scapula, also to secure fixation of the humerus after reductions of dislocations of the shoulder-joint. Two rollers two and a half inches in width by eight yards in length are employed.

Groin.—**SINGLE SPICA BANDAGE OF THE GROIN.** The initial extremity of the roller is passed obliquely upon the surface of the right thigh and secured by one or two circular turns around the limb, then carried obliquely across the abdomen to a point just below the crest of the ilium and conducted transversely around the back of the pelvis to a corresponding point on the opposite side, bringing it obliquely down over the lower portion of the abdomen, crossing the first turn, to the junction of the thigh with the scrotum, passing it under the thigh and up and over the lower part of the abdomen, then allowing it to follow the course of the first turn. These

turns are repeated, each turn descending and overlapping two-thirds of the previous turns until the groin is covered.

In applying this bandage to the left groin, after the initial extremity of the roller is fixed it is carried first to the crest of the ilium of the same side, then around the back of the pelvis to a corresponding point on the opposite side, then obliquely across the lower part of the abdomen to the outer side of the thigh, being carried under this and brought up between the thigh and scrotum, then passing obliquely over the groin to pursue the course of the original turn. It may be used either single or double to retain dressings to wounds in the inguinal region, as in herniotomy, abscesses of the groin, and for the temporary retention of hernia, etc. The roller is two and a half inches in width and eight yards in length.

SPICA BANDAGE OF BOTH GROINS. The initial end of the roller is started by passing from right to left and from before backward around the abdomen and obliquely downward from the right iliac crest to the outer side of the left thigh, encircling it and passing around the back of the pelvis to the right groin, from which point it descends to the inner side of the corresponding thigh. The roller is carried completely around it and thence obliquely upward across the pelvis to the left side, passing transversely along the back to the right ilium, pursuing a similar course, and terminating the bandage by a circular turn. Its use is the same as the single bandage of the groin. The roller is three inches in width and ten yards in length.

Leg.—**SPIRAL REVERSED BANDAGE OF THE LOWER EXTREMITY.** The initial extremity of the roller is placed upon the leg a little above the malleoli and secured by a few circular turns, then carried obliquely over the foot to the metatarso-phalangeal articulation and a circular turn made around the foot; the foot is next covered in with two or three spiral reversed turns and two figure-of-eight turns over the ankle and instep, and a little above the ankle one or two circular or spiral turns are made around the leg. The turns are to be continued up the leg, and as it increases in diameter spiral reversed turns are made until it approaches the knee. If the limb is to be kept straight the spiral reversed turns may be continued over this part and upon the thigh. If the knee is to be bent figure-of-eight turns may be used until the knee is covered, then the thigh is covered with spiral reversed turns. This bandage is used in the treatment of fracture, ulcers, varicose veins, dislocations and edema. Two rollers two and a half inches in width and eight yards in length are required.

Foot.—**BANDAGE OF FOOT WITHOUT COVERING THE HEEL.** This is begun a little above the malleoli and secured by a few circular turns, the bandage is then carried obliquely across the dorsum of the foot to the metatarso-phalangeal articulation and a circular turn made around the foot, then upward, covering the foot with two or three spiral reversed turns, and then using the figure-of-eight turn around the ankle and instep. This should be repeated once, which will cover in the foot with the exception of the heel. It is continued up the leg with spiral reversed turns. It is useful in retaining dressings to the foot, etc. The roller is two and a half inches in width and eight yards in length.

Plaster of Paris Bandages.—The plaster used for this purpose should be the fine white powder, as used by dental surgeons or modelers, of the extra-calcined variety, and should be fresh as it deteriorates by the

absorption of moisture. The material used in this bandage is cheese-cloth, mosquito netting or crinoline, the latter being the best fabric. They are cut or torn into strips two and a half to three inches in width and five yards long, placed on a table and the dry powder rubbed into the meshes on both sides, the bandage being then rolled loosely. They should be kept in a covered jar so as to exclude the moisture and when they are to be used they should be set on end in a basin of water, deep enough to cover them, and allowed to remain several minutes, so as to become thoroughly saturated. The part to be covered should be first encased in either

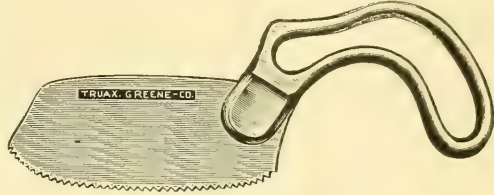


Fig. 989.
Bergmann's Plaster Saw.

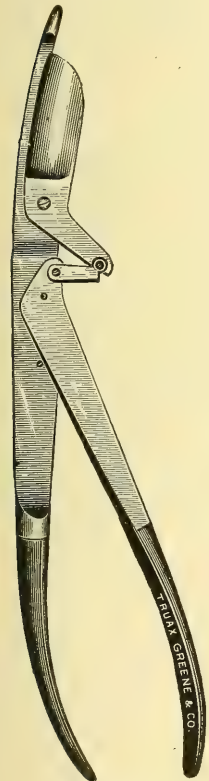


Fig. 990.
Brun's Shears.

flannel or muslin bandage which has been shrunk by being washed. A few circular turns of the plaster bandage should be taken over the limb to fix the muslin or flannel bandage; reversed turns should be avoided, and each fold of the bandage should overlap the preceding one. To increase the strength of the casing a bowl of plaster of Paris is to be mixed with water to the consistency of cream, and applied over and between the layers of the bandage. Narrow strips of tin, zinc or binder's boards are also used in the layers of the bandage, these increasing the strength of the casing.

In removing the plaster of Paris bandage some times great difficulty is experienced, especially if it is to be removed before the parts below it are consolidated, as it may disarrange them and cause the patient pain if it is not accomplished without much force.

When applying the bandage to obtain a cast of the part a strip of sheet lead one inch in width should be placed over the flannel bandage and allowed to extend beyond each end of the dressing; the plaster can then be easily cut through upon this strip of lead with a sharp knife without injuring the parts below. It may also be removed by means of Bergman's plaster of Paris bandage saw or by a strong cutting saw, as the Gowan's plaster of Paris bandage saw, which is recommended in removing the Sayre's plaster of Paris jacket.

Sayre's Plaster of Paris Jacket.—DESCRIPTION. The following is in Sayre's own words:

The first requisite is an elastic woolen shirt, knitted and without seams, similar to a stocking, with tapes at the top to tie over the shoulders instead of sleeves, as the shirt can then be pulled tightly down and secured by a safety pin between the limbs and thus, by its elasticity, be made to fit accurately all the inequalities of the trunk. Previous to its being thus secured a pad of cotton folded in a napkin should be placed under the shirt over the region of the stomach, and in women it should also cover the mammæ. After the plaster has set the pad is to be removed and thus room allowed for the stomach to expand after meals and

also to prevent any undue pressure on the mammary glands. The bandages should be made of coarsely woven muslin, called crinoline, so that the plaster can be rubbed into its meshes. They should be from three to four inches wide and about three to four yards long. The gypsum should be pure, freshly ground and perfectly dry, and should be rubbed into the meshes of the cloth; these are then rolled, but not too tightly. Thus prepared the bandages can be kept in an air-tight vessel ready for use at any moment. If the climate is very wet it is as well to subject them to the heat of an oven for a few minutes before using, to evaporate any moisture the plaster may have absorbed. When about to apply the dressing the surgeon takes a single roll of the bandage and drops it into a vessel of cold water, which should be deep enough to completely immerse it in a vertical position, and as soon as all the gas has escaped it is ready for use. As he removes it from the water he squeezes out the surplus water and drops into the basin another roll—end up—and by the time the first one is applied the next will be ready for use. This is to be continued until as many are applied as each particular case may require, the jacket being strengthened by strips of tin placed between the layers of bandage.

In cases of spondylitis the patient is to be carefully extended by the head and axillary straps until he is perfectly comfortable, and never beyond that point. As soon as the patient has been extended until he is perfectly comfortable, apply the wet roller bandage smoothly over the skin-fitting shirt, not drawing it tightly, but simply unrolling it around the body, while an assistant follows with his hand and fingers and presses it into all the inequalities and irregularities of the body, thus obtaining an accurate mould of the trunk in the improved position which extension has given it, and by keeping the patient in this position for a few minutes until the plaster has set he will then be retained exactly in the same position so long as the plaster remains unbroken.

After the plaster has set the pads which have been placed over the stomach and mammæ are to be removed.

Slight pressure should be made over the lower part of the abdomen on the cresta ilii before the plaster has hardened, so as to mould it to the form and remove the undue pressure on the spinous processes and the crest of the ilium. As soon as the plaster has set the patient (unless paralyzed) can go out of doors and take the ordinary exercise so necessary for health, and, if an adult, can resume some active employment by which he can earn his support.

When the deformity is in the neck it may be necessary to affix a jury-mask to the back of the jacket during the process of making it, from which a strap passes beneath the chin to support the head and make slight and constant extension upon the cervical vertebræ. The advantages claimed for this plan of treatment are:

First. Its applicability in all cases where any mechanical treatment can be applied by any surgeon in the country, without the aid of an instrument maker.

Second. That, being accurately adjusted to all parts of the body when in its improved position, it gives more uniformity of support than can be done by any other means, and without making any undue pressure at any point, and thus avoids all danger from sloughing and excoriations.

Third. By absolutely immobilizing the spine and removing undue

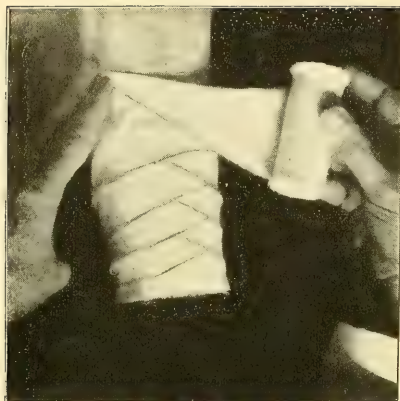


Figure 1. Spiral Reversed.

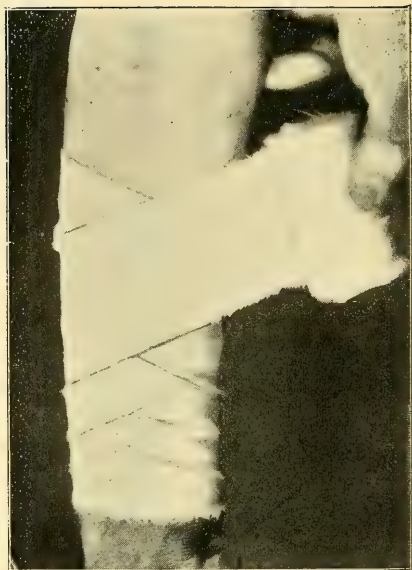


Figure 3. Figure-of-Eight Spica.



Figure 2. Thigh Spica.

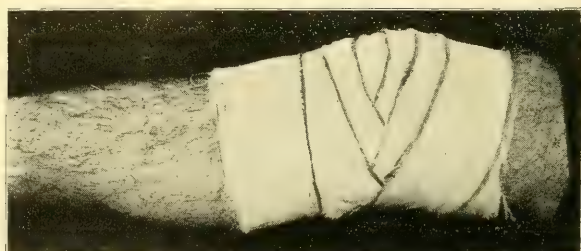


Figure 4. Knee—Figure-of-Eight.

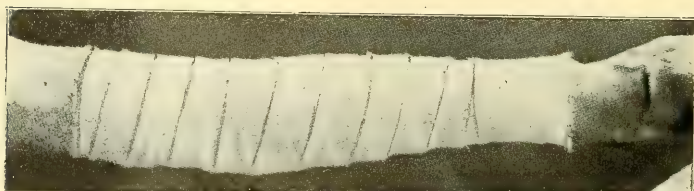


Figure 5. Descending Spiral Bandage.

pressure from the inflamed portion of the *vertebræ* it affords greater facilities for ankylosis than can be given by any movable apparatus.

Fourth. The patients thus treated are capable of daily exercise in the open air, so necessary for health, and also for earning their support by manual labor.

Fifth. By applying this treatment in the early stages of the disease the patient will be cured (when curable) without any deformity.

Bavarian Plaster of Paris Splints.—Take two pieces of canton flannel the length of the part to be enclosed and a few inches wider than the circumference of the leg, stitch them together along the middle line for the length of the leg, and beyond this cut them through in the same line; put the flannel behind the limb with the seam exactly in the middle, bring the inner layer around and pin it along the front of the leg, the dorsum and sole of the foot, so as to form a tightly fitting stocking. Smear this layer all over with plaster of Paris cream, and before it sets press the outer layer, already cut to the proper size, evenly over it. When the plaster has set remove the pins from the inner layer of flannel and bring the borders of the latter around the edge of the splint in front and along the sole, and stitch it to the outer layer.

This forms an accurately fitting splint which can be easily removed without in any way disarranging the limb, as the seam along the back of it acts as a perfect hinge.

Starch Bandage.—The starch is mixed with cold water and is to be of the consistency of that used by laundresses. The part to be dressed is first covered with a flannel roller and, over this, by a few layers of cheesecloth; the starch is then rubbed in well or smeared with the hand in the meshes of the material, and the part is again covered with a layer of turns of the bandage and the starch again applied; this is continued until a dressing of the desired thickness is produced. To give additional strength to the dressing strips of binder's board may be inserted between the layers of the bandage.

It requires about twenty-four to thirty-six hours for the starched bandage to become dry and thoroughly set. It is to be removed in the same manner as the plaster of Paris bandage.

Materials for Surgical Dressings.—**LINT.** Surgeon's lint is a material much employed in surgical dressings. There are two varieties—the domestic lint, which is composed of pieces of old linen or muslin which has been thoroughly boiled and then dried, and the surgical lint, which is manufactured and resembles canton flannel in appearance. The latter is the best material on account of its greater absorbing capacity. It is used in the application of wet dressings of the various solutions, such as lotions of lead water and laudanum or dilute alcohol, in the use of compresses, in the treatment of fractures, to control hemorrhages or to make pressure.

OAKUM. Oakum is a material made from tarred rope and supposed to contain antiseptic properties due to the tar with which it is impregnated. On account of its great elasticity it makes an excellent material for padding splints or other surgical appliances. It is also used in the form of pads to place under patients to relieve portions of the body from pressure and to absorb discharges which soak through the dressings.

COTTON. Absorbent cotton is first boiled in strong alkaline solution

to remove the oily matter which it contains. When so prepared and on account of its great absorbing capacity it is largely used in surgical dressings. Because of its inexpensiveness it can be thrown away after the first application and a new piece used, and thus the danger of carrying infection from one wound to another is diminished. It is highly recommended in gynecological practice, for making applications to the female genital organs. It is prepared and impregnated with various antiseptic substances, such as the bichloride of mercury, carbolic acid, boracic acid, salicylic acid, etc.

JUTE. Jute is another dressing used in dressings and is employed for much the same purposes as oakum and cotton. It possesses both elasticity and absorbent qualities.

MOOSE-PAPPE. As a dry dressing the moose-pappe is perhaps the most convenient. It can be rapidly crumbled on thin gauze, which is then folded loosely over it. As a moist compress for ulcerating surfaces moose-pappe lightly dipped in a boric or other antiseptic fluid makes an ideal dressing, while as a padding for splints, particularly in cases of compound fracture, or fracture complicated with flesh wounds, it will be found most satisfactory.

Even when not rendered especially antiseptic the deodorant powers of moose-pappe are not less remarkable than its absorbent powers, and this renders it particularly useful as an application to foul ulcers or septic wounds. While with an ordinary absorbent daily dressings are required the busy practitioner may safely leave his moose-pappe dressing two or even three days and will find it more or less odorless when it is removed.

WOOD-WOOL. Wood-wool, made from wood-pulp, such as is used in the manufacture of paper, is also made in the form of lint, sponges and pads, and can be used for the same purposes as the ordinary surgical lint.

OIL-SILK OR MUSLIN. In order to prevent rapid evaporation from the dressings these excellent materials are used as an external cover.

WAXED OR PARAFFINE PAPER. This dressing forms an excellent and cheap substitute for oil-silk or muslin. It is prepared by passing sheets of tissue paper through melted wax or paraffine and then allowing them to dry.

GUTTA-PERCHA. Gutta-percha is another form of material which can be used as a cheap and satisfactory substitute for oil-silk or muslin. It is prepared by rubber manufacturers and consists of rubber run out into very thin sheets.

PARCHMENT PAPER. This paper is prepared so as to render it waterproof. It is employed in surgical dressings for the same purpose as oil-silk or gutta-percha.

Tampons.—This form of dressing for the application of various medicines is used in the form of a compress employed in cavities to make pressure and to control hemorrhages, etc.

The application of a tampon to the vagina is a favorite method of controlling hemorrhage.

Tampons composed of strips of bichloride or iodoform-gauze or of pledgets of bichloride cotton are used to control hemorrhages. This subject is continued further in the Chapters on Antisepsis.

Splints.—Splints are made of various materials and of many shapes and are used as dressings in the treatment of fractures or in some

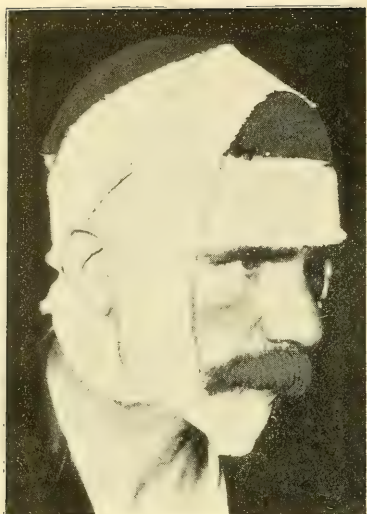


Figure 1. Modified Barton's.

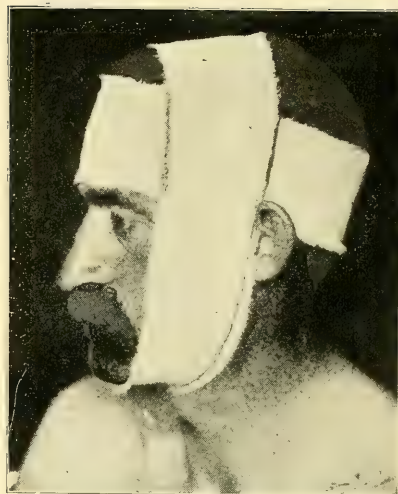


Figure 3. Occipito-Facial.



Figure 2. Recurrent of Head, No. 1.

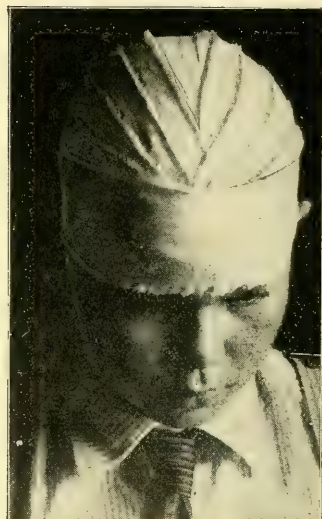


Figure 4. Recurrent of Head, No. 2.



Figure 5. Recurrent Bandage.

morbid condition that will demand the immobility of a limb, etc. Splints may be made of wood, tin, lead, copper, plaster of Paris or wire, or whatever material may be handy, as long as it has the requisite amount of firmness.

WOODEN SPLINTS. The simplest and perhaps best splints are made from wood—white pine, willow or poplar being the best material to employ for their construction. Before being applied to the limb wooden splints should be well padded with cotton, wool, oakum or hair. Binder's board or pasteboard makes an excellent material from which to construct splints. It is first soaked in boiling water and when sufficiently soft is padded with cotton or a layer of lint, molded to the limb and secured in position by a bandage. As it becomes dry it hardens and retains the shape into which it was molded.

UNDRESSED LEATHER. This makes an excellent material for splints. It is applied the same as the binder's board.

FELT. Felt is also employed extensively in the construction of splints. In applying this material it should be heated before the fire until it becomes pliable or by dipping it into boiling water.

GUTTA-PERCHA. Splints made from sheets of this material, in thickness from one-sixteenth to one-fifth of an inch, may be used to great advantage. It is prepared for use by immersing it in hot water until it becomes soft and can be molded to the surface.

PLASTER OF PARIS, STARCH, CHALK, AND GUM SILICIS OF POTASSIUM AND SODIUM are also excellent splint materials, especially the plaster of Paris dressing, which is used extensively at the present time.

Fracture Box.—A fracture box consists of a bottom, a foot piece and two movable side pieces eighteen to twenty inches in length, or made to suit the case. If any extension is needed it may be secured by a bandage around the ankle and foot, which is also passed through the holes in the foot piece.

In arranging the leg in a fracture box the sides are turned down, a thick layer of cotton or some soft material is arranged for the leg to rest upon, and shaped to fit the natural contour of the calf. The sides are also packed, turned into position and fastened.

Special Splints.—**EVANS' FOLDING FRACTURE BOX.** The great difficulty experienced in dressing wounds of the leg without disturbing the wounded extremity, or in cases of compound fracture, has led to the construction of an apparatus of which the following is a description.

It is made of tinned iron to prevent rusting and consists essentially of a back-piece, sides and foot-rest, and has an oval-shaped opening to accommodate the tendon Achillis and heel. The sides are jointed to the back-piece by hinges and are kept in position by a thumbscrew. The foot-rest can be firmly secured at different angles by a rack at the back, thus preventing either backward or forward movement. At the end of the splint is a support with which to raise the foot so as to prevent pressure on the heel. When not required it can be turned up, and fits into the space between the two wings.

New Extension Apparatus.—The Rack-Pinion extension apparatus is designed with a view of enabling the surgeon to apply gradual extension to the leg from the acetabulum down, and will be found most efficient in fractures, hip-joint disease, partial ankylosis of the knee-

joint and muscular contractions evolving shortening of the tendons in the popliteal space.

METHOD OF APPLICATION. Two pieces of strong roller bandage two and a half to three inches wide are cut to a length eight or ten inches longer than the foot, measuring from one inch below the knee. These are securely fastened to the outside and inside of the limb with adhesive plaster, confining the whole with a roller bandage, properly applied, extending from below the knee to the ankle. The patient being placed on his back, the splint is fastened to the outside of the affected limb at

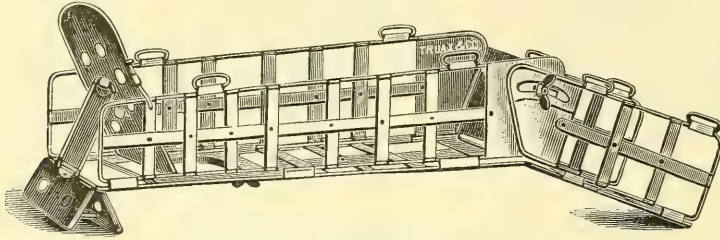


Fig. 991. Evans' Folding Fracture Box.

the hip by means of the perineal band. The distal end is fastened to the extension-apparatus by means of the tape

previously secured to the limb. The perineal pad furnishes the counter-extension, but, is likely to become unbearable and in fractures, at least, the results are liable to be just as good without it.

Adjustable Angular Splint.—This splint can be applied either anteriorly or posteriorly, and is conformable and adjustable to any angle. The pieces are detachable and can be used separately. This splint is applicable to diseases and resections of the elbow-joint. It makes a very light and cool splint, the perforations allow ventilation, and secretions are not confined and liable to be absorbed, as in other kinds of splints. They do not become offensive like splints made of porous materials.

Meacher's Leg Splint.—In the treatment of ordinary fractures of the leg and ankle this splint has all the advantages of a plaster of Paris

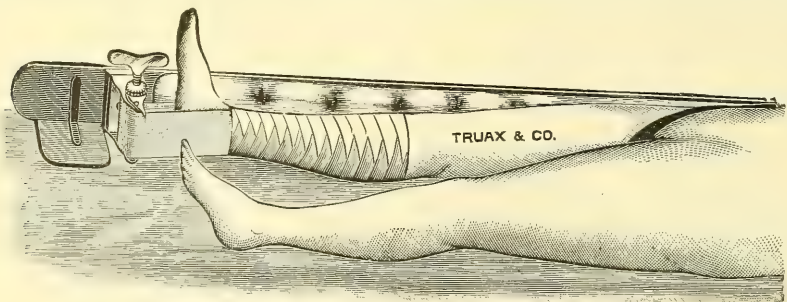


Fig. 992. Macwhinnie's New Extension Apparatus.

cast with none of its disadvantages. The splint is so easy to apply that any intelligent person, even though not a surgeon, might, if necessity required, treat a fracture of the leg or ankle with it with very fair success.

Fractures near the knee-joint will require a splint that extends to the thigh. To apply the splint the surgeon takes a sheet of common cotton wadding, cuts two or more pieces a little longer than the splint and ten inches, more or less, wide, and lays these on the splint, then lets the leg



Figure 1. Velpeau, No. 1.

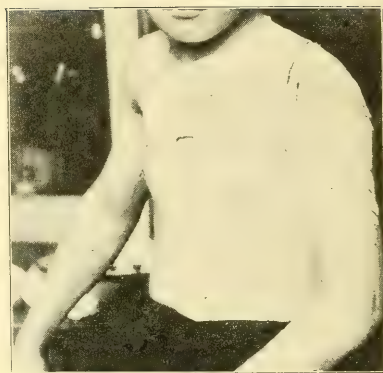


Figure 3. Spica of Shoulder.



Figure 2 Velpeau, No. 2.

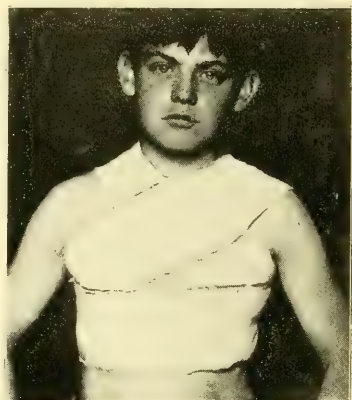


Figure 4. Breast Bandage.

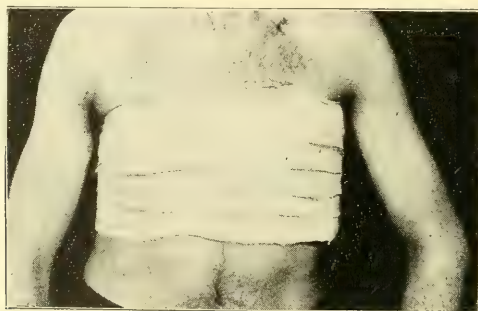


Figure 5. Spiral of Chest.

PLATE LI, E.

slip down into the splint, carrying the padding with it, which will make the padding smooth under the leg. He then puts one or two turns of bandage around the foot and foot-piece. The leg and splint are next bandaged together. Pressure can easily and comfortably be made on any part of the leg by a compress of cloth or cotton and a few turns of the bandage. The advantage of this splint is that it allows examination of the fracture at any time by simply removing the bandage.

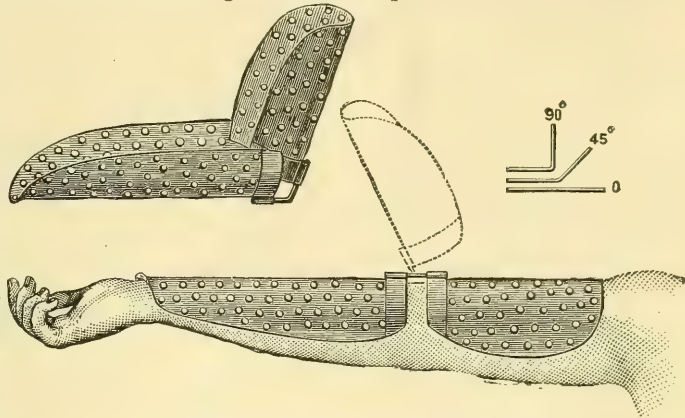


Fig. 993. Adjustable Angular Splint.

When it is applied the patient is not obliged to lie on his back but may lie on either side and may get about on crutches as soon as if the leg were in a cast. The appearance of Meachers' leg splint may be seen from Fig. 994.

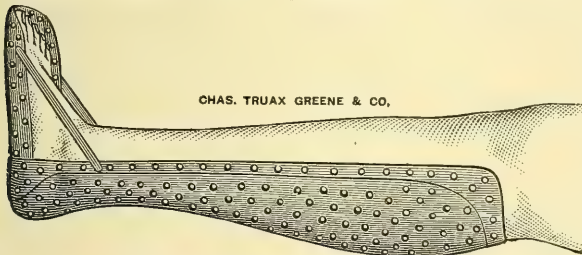


Fig. 994. Meachers' Leg Splint.

the adjustable angular splint, spoken of above, which is also a device to be recommended is given representation in Fig. 993.

Evans' folding fracture box, as illustrated in Fig. 991, is an ingenious device of some merit, Fig. 992 shows an extension apparatus which was introduced by MacWhinnie, and has been used to good purport; and

CHAPTER II. HEMORRHAGE.

Importance.—Hemorrhage, whether it be the result of accident or disease or incidental to surgical operations, the amount being slight or alarming, always claims prompt attention and often demands a manifestation of all the surgeon's skill and self-possession. Hence, it is necessary to be familiar with the various forms which it may assume and with all the available means for arresting it.

Varieties.—The varieties of hemorrhage are arterial, venous and capillary; and these are again classified, according to the time of their occurrence, as primary—that is, bleeding which occurs at the time the wound is inflicted; and secondary—that which takes place any time after the completion of an operation or first stenching of the blood. There are other classifications of hemorrhage as regards time, but this is the simplest and fully as correct as any.

Hemophilia.—The hemorrhagic diathesis is a peculiar constitutional defect, which seems to consist in a want of contractility of the arteries and of coagulability of the blood, so that the slightest wound bleeds almost uncontrollably and life may be lost through the most trifling injury or surgical operation. This diathesis often runs in families and the surgeon would do well to refrain from operations with the knife on the individual possessing it. The cases of four children are recorded who were born of healthy parents, their skins were white and complexion fair, they were subject to fever with ecchymosis, their blood was very thin, but coagulated in the usual manner, violent coughing produced hemoptysis or epistaxis, and any slight injury caused ecchymosis of the skin. One died at twenty months from biting his tongue, another at eight years from general mucous hemorrhage, and a third at twelve from epistaxis.

Sources of Hemorrhage.—The arterial, venous and capillary forms of hemorrhage are readily distinguished from each other. When an artery is wounded the blood escapes in jets with each heart-impulse, and is of a bright red color; venous blood, on the contrary, flows steadily, and is of a dark purple hue. If the bleeding proceeds from the capillaries, there will be a general oozing of red blood from the surface of the wound. In the division of a large artery, however, the blood may flow from its distal extremity, welling out in very much the same manner as from a vein; its true source in this instance is to be determined by its color. On the other hand, venous blood may be given forth in jets, owing to the vein being placed immediately over an artery and having the pulsations of the latter communicated to it. Here the dark color of the blood will disclose its source. As a general rule it may be remarked that no fears need be entertained concerning the division of the capillaries or of veins of medium size, as the spontaneous coagulation of the blood is sufficient to prevent any serious loss.

Constitutional Treatment.—The treatment of hemorrhage is either constitutional or local.

The constitutional treatment consists in keeping the patient in the recumbent posture and avoiding any sudden elevation of the head or arms which might induce fatal syncope. Opium, in the thirtieth potency, is a valuable remedy and should be used when the heart is in an irritable condition. Ergot, gallic acid, aconite and iron may also be used in potency as indicated. Nourishing diet is demanded, but stimulants and food should be administered only in exceptional cases, and in extreme cases auto-transfusion or transfusion of blood or normal salt solution may be resorted to.

Local Treatment.—**POSITION.** Elevation of the part will sometimes be sufficient to arrest bleeding, and will always diminish the loss of blood in an operation by favoring a return of venous blood to the heart.

THERMA. By lowering the temperature of the part to a degree of constriction upon the vessels that favors coagulation this is secured, thus becoming a very effectual agent.

DIGITAL COMPRESSION. This is one of the most valuable means employed in the temporary control of hemorrhage. If possible pressure should be made against a bone, and not against muscles which offer but slight resistance. The finger should be pressed directly upon the bleeding vessel in the wound, or be used to make pressure upon the artery from which the bleeding arises at some point between the wound and the centre of the circulation. The femoral artery should be compressed with both thumbs upon the edge of the pubes, and the brachial with the fingers against the humerus. The subclavian can be suppressed above the clavicle against the first rib with the thumb or the handle of a door-key wrapped in lint.

TOURNIQUETS. These instruments, which are employed for the temporary control of hemorrhage from wounds are of many different kinds. Petit's tourniquet is likely to slip, has the disadvantage of impeding the venous circulation and is therefore inapplicable for prolonged use. It consists of two metal plates connected by a strong linen or silk strap, with a buckle, the distance between the plate being regulated by a screw. In applying this tourniquet a compress or roller is placed directly over the artery to be compressed, and may be held in position by a few turns of the roller bandage.

Signorini's tourniquet is frequently employed to control the circulation in the femoral artery in cases of operations on the thigh and leg, and in the treatment of femoral or popliteal aneurism.

In cases of sudden emergency a tourniquet may be improvised from a handkerchief tied firmly around the limb and a stick twisted in it to keep up pressure.

Hemostatic forceps now in general use are self-retaining, and their use has done much to diminish the shock from the loss of blood during operations. They are clamped upon the bleeding vessel and allowed to remain till the hemorrhage has stopped or the vessel is ligated.

ESMARCH'S BANDAGE AND CORD. Esmarch's bandage and cord afford very effectual means for arresting hemorrhage or rendering a limb bloodless previous to an operation. The bandage is applied to the extremity of the limb and from thence is carried up the limb to a point some distance above the seat of operation. The bandage is applied firmly,

each turn overlapping one-fourth of the preceding one, and when the last turn has been made the rubber tube or strap is wound firmly around the limb and secured by fastening the hook into one of the links of the chain. After securing the tube or strap the rubber bandage is removed from the limb and if the tube has been firmly enough applied the limb will be found to be blanched, and should be free from blood during the operation. Care should be taken not to apply the tube or strap too tightly in poorly developed limbs, or on parts of the limb where large nerve trunks approach the surface, as they may be subjected to an amount of pressure which will interfere with their functions subsequently.

It is useful in amputations and removal of vascular tumors from the limbs, etc. In operations upon bone, either osteotomy or sequestrotomy, it is especially useful, as it allows the surgeon to have a view of the parts unobscured by hemorrhage.

ACUPRESSURE. Acupressure is pressure with a pin passed under a vessel, leaving a little tissue on each side between the pin and vessel. A needle can be passed under a vessel (circumclulsion), or by inserting it upon one side, passed through half an inch of the tissues up to the vessel, giving it a quarter twist and driving it into the tissues across the artery (torso-occlusion). Some tissue is picked up on the needle, folded over the vessel and pinned to the other side (retro-occlusion.)

Acupressure is used for inflamed or atheromatous vessels, in sloughing wounds, and where a ligature will not hold.

CAUTERIZATION. Cauterization by means of a hot iron is an old method of arresting hemorrhage. If used the iron should be only of a dull-red or black heat, as the result desired is not the destruction of the tissues but the coagulating effect of the heat upon them.

PAQUELIN CAUTERY. The paquelin cautery is the apparatus most frequently used.

Special Hemorrhages.—**HEMORRHAGE IN SCALP WOUND.** If no large artery (temporal or occipital) is wounded, pressure alone is sufficient treatment and this is best applied by putting the edges of the wound in apposition. After thoroughly cleansing them with warm carbolic lotion the skin around the wound should be shaven and scrubbed thoroughly with a nail brush and carbolic lotion so that both the extent of the injury may be clearly seen and the coaptation of the edges may not be interfered with. The opening should be enlarged if necessary, but it is essential always to secure the vessels and control the bleeding, either by compression with artery forceps, torsion or ligation. Scalp wounds may be accompanied by fracture of the skull. It is very important that this be remembered, as the hemorrhage in these cases may come from within the skull and be beyond the surgeon's control until the skull has been opened over the bleeding point.

WOUNDS OF THE FACE. Face wounds bleed freely and frequently require a ligature, though pressure can be very well adapted to the parts about the jaws. Sutures will often be required in wounds of the face in order to diminish the width of the scar, and if so very fine silk, silk-worm sutures, or fine sheep-gut sutures are the best.

LIP WOUNDS. Either lip may be cut through by a blow or fall, hemorrhage from the divided coronary artery being generally profuse. The introduction of a harelip pin and the application of a twisted suture

form the best treatment. Two days are generally sufficient for the pin to remain in the lip, but the scab should be left untouched until it drops off spontaneously.

HEMORRHAGE FROM THE NOSE. Nasal hemorrhage, the result of a blow, is generally slight and may be alleviated by the application of cold water. The patient should sit erect and a sponge be held to the nose. If these simple means fail to arrest the bleeding the nasal cavity may be packed with strips of sterile gauze introduced into the anterior nares and pushed backward by a probe or director.

Another method of controlling hemorrhage from the nose consists in introducing a small piece of sponge tied to a strong silk ligature into the anterior nares and pushing it along the floor of the nose to the posterior nares. A small piece of sponge about the size of a marble with a hole in the centre is threaded on this ligature and pushed back until it comes in contact with the first piece of sponge introduced, and thus by introducing a number of pieces in this way the nasal cavity may be completely filled and the bleeding arrested. The sponges should be rendered thoroughly aseptic, and the nasal cavity should also be washed out with an antiseptic solution before their introduction. The sponges may be allowed to remain in place for twenty-four to forty-eight hours.

HEMORRHAGE FROM THE EAR. Hemorrhage from the ear after a blow is generally caused by slight rupture of the lining membrane of the meatus, which can be easily seen through an ear speculum and must not be taken as a symptom of fractured skull.

HEMORRHAGE FROM THE TONGUE. A bitten tongue may give rise to severe hemorrhage if the wound happens to be in the thickness of that organ.

Ligatures are of little avail, as they almost invariably pull off, and if cold or heat does not arrest the flow of blood, torsion or the actual cautery should be applied to the bleeding points. Sutures may be introduced through portions or all of the organ, or, an incision may be made and the bleeding vessel be picked up and torsion or ligation be practiced.

CUT-THROAT. There is often considerable hemorrhage at first from two or three small arteries, but this may easily be arrested by ligatures or torsion if the cold air has not already been sufficient to stop the bleeding. Wounds caused by attempts at suicide are generally made in the space between the hyoid bone and thyroid cartilage and the incision does not go near the carotid arteries. The incision will vary considerably both in size and depth. An incision "from ear to ear" may be only skin deep, while another of smaller extent may have divided the trachea and even the esophagus. The patient is generally in a very depressed condition, owing to the mental condition which gave rise to the attempt. A small quantity of nourishment, such as a couple of tablespoonfuls of beef-tea and one of brandy, repeated at short intervals, should be given at once if depression from bodily want prompted the effort at self-destruction. If the pharynx is uninjured this can be readily swallowed, but if it is wounded the stomach tube must be used, the tube being introduced with great care—if necessary the fingers being inserted into the wound to insure its taking the right direction.

Occasionally, when the thyro-hyoid membrane is so completely divided that the larynx drops out of position, it may be necessary to suspend it by

deep sutures, uniting the hyoid bone and the thyroid cartilage. After all hemorrhage has been arrested and the wound rendered aseptic it should be closed by sutures. If breathing should become embarrassed the wound must be re-opened without delay and a tracheotomy tube be introduced.

The position of the patient is very important. His shoulders should be raised by pillows so as to make the head bow forward, provided the patient is sane. In insane or unruly cases it will be better to carry a bandage around the forehead and bring the ends from the temple down to a waistband in front and attach it there. The great danger in cases of cut-throat, after the immediate consequences of hemorrhage and shock are passed, is inflammation of the lungs owing to the entrance of cold air and septic matter through the wound. This is best obviated by the application of hot, moist, boric lint, folded and laid lightly over the wound beneath oil-silk and renewed as often as it becomes cold or dry. It at the same time assists in the granulating process and in keeping the wound sweet.

STABS IN THE ABDOMEN. These wounds may cause considerable hemorrhage from wounded vessels in the parietes, which can be easily secured, but apparently slight wounds may perforate the peritoneum and wound the intestines, causing internal hemorrhage. An exploratory incision may be advisable. If the intestine is wounded and exposed it should be stitched with fine silk or sheep-gut sutures, these passing through the peritoneal and muscular coats only so as to bring the two surfaces of the peritoneum into apposition. If the blood accumulates so rapidly as to prevent the location of the bleeding point, the aorta may be compressed, or the abdominal cavity packed with large sponges or gauze.

WOUNDS OF THE PALMAR ARCH. If necessary the wound should be enlarged in the direction of the flexor tendons. A tourniquet should be temporarily applied while the wound is examined; the ends of the arch should be caught with hemostatic forceps and both ends be tied. If the artery cannot be caught with forceps a tenaculum may be used to pick it up. As an additional precaution, pressure may be made upon the radial and ulnar arteries at the wrist with pieces of elastic catheter wrapped in lint beneath the bandage, and the hand bound up to the opposite shoulder.

UMBILICAL HEMORRHAGE. Hemorrhage from the navel in infants requires pressure over a plug containing tannin or alum, or the passing of a hairlip pin under the navel and the application of a twisted suture. If this fails the actual cautery may be used.

RECTAL HEMORRHAGE. This form of hemorrhage can be controlled by the injection of cold or astringent injections, to find out the source of the hemorrhage. A rectal speculum should be introduced, and when ascertained the actual cautery or a ligature should be applied. If the bleeding persists or if a vessel of considerable size is bleeding, the bowel should be caught and drawn down, the vessel seized and tied if possible. By the use of Pratt's speculum and artery forcep this may be readily accomplished.

BLEEDING FROM THE URETHRAL MEATUS. Hemorrhage here is controllable by the application of pressure, hot injections or by tying a condom over a catheter, and after inserting it, inflating the condom by blowing through the catheter and plugging the orifice of the instrument, thus using pressure. Sitting with the perineum on a thickly-folded towel or

the application of ice to the perineum may also be tried. If these means fail an external urethrotomy may be performed and the bleeding point be found and tied.

HEMORRHAGE FROM THE BLADDER. The first portion of the urine may be blood-stained and the last portion contain more blood and clots as the organ contracts, which distinguishes bladder-bleeding from hemorrhage from the kidneys—in which the admixture of blood with the urine renders it of a smoky color, or dark-red if the bleeding is profuse. If blood-clots prevent the flow of urine they should be broken down with a catheter, and vinegar and water injected. The patient should be kept perfectly quite and given cold acid drinks. Ice-bags should be put to the perineum and hypogastric region and if the hemorrhage is severe or persistent suprapubic cystotomy may be performed for its cure.

VAGINAL HEMORRHAGE. Hemorrhage from the vagina requires the ligature or the tampon. In severe uterine hemorrhages (unconnected with pregnancy), due to morbid growths, the ligature or the tampon may also be used, or removal of the tubes and bandages, ligation of the uterine and ovarian arteries or hysterectomy may be necessary.

RUPTURED VARICOSE VEINS. In the lower extremities these may give rise to dangerous hemorrhage. Pressure upon and below the wound stops the bleeding. The limb should be carefully supported in an elevated position, and even compression be applied.

CHAPTER III.

HYPODERMIC MEDICATION AND CATHETERIZATION.

Hypodermic Injections.—The administration of remedies by hypodermic injections is accomplished by the use of a syringe provided with a perforated needle through which drugs are passed into the cellular tissue and rapidly absorbed. Great care should be observed to avoid introducing the needle into a large vein or artery, as by neglect of this precaution serious symptoms have resulted, from the drug being thrown rapidly into the circulation instead of being slowly absorbed from the subcutaneous tissue. The syringe should be kept clean, as an unclean syringe or a solution which has not been sterilized may give rise to a troublesome abscess at the site of the injection.

The hypodermic syringe is best sterilized by boiling ten minutes in a five per cent. carbolic solution.

Catheter and Bougies.—These are usually made of silver, linen, silk, gum-elastic or glass. The female catheter is shorter and has a much smaller curve than the instrument used for the male urethra. The catheter is often used in cases where the walls of the bladder lose their tonicity, which is frequently the case in aged people, also in cases of typhoid fever, injuries of the brain and cord when the reflex actions are imperfect, in spasmodic or permanent stricture of the urethra, when the neck of the bladder is closed by an enlarged prostate, by pressure of the uterus, in cases of obstruction from a small calculus, in rupture of the urethra or in washing out the bladder, etc.

INTRODUCTION OF MALE CATHETER. The patient is placed in the recumbent posture, resting squarely on his back, the thighs being slightly flexed and separated. The surgeon, placing himself on the side of the patient, exposes the head of the penis by raising it between the middle and last two fingers of the left hand, and with the thumb and finger retracts the prepuce if required. Then holding open the end of the catheter previously warmed and oiled, in his right hand between the thumb and first two fingers, he gently passes it along the urethra until its point passes beneath the symphysis pubis. At this point the handle is elevated and gently depressed between the thighs, and the beak will pass into the bladder. In reaching the prostatic region if any difficulty is experienced in passing the catheter introduction of the finger into the rectum and guiding of the catheter through this are sometimes required, or if the prostate is found much enlarged the catheter should be withdrawn, and a prostatic catheter should be substituted for it. In passing metallic sounds the same manipulations are made use of, as in passing a catheter.

THE FEMALE CATHETER. First, the catheter and meatus should be cleaned, then the catheter is taken in the right hand and introduced along the forefinger of the left hand between the nymphæ, bringing it from behind forward until the space between the entrance of the vagina and the orifice of the urethra is found. The catheter is then introduced with the

right hand and, guided by the left forefinger, is passed through the orifice of the urethra into the bladder. The female catheter should be of glass so that it may be easily sterilized by boiling.

RECTAL TUBE AND BOUGIE. In flushing out the colon or giving enemata the patient is placed upon his left side, the surgeon introducing his index finger, well-oiled, into the rectum and guiding the tube upon this through the anus, till by gentle pressure it is gradually passed into the rectum. In the case of a stricture it is best, if possible, to pass the forefinger up to the stricture and thus guide the tube or bougie through the obstruction. Sometimes the tube catches in one of the transverse folds of the mucous membrane of the rectum and merely bends upon itself, when it must be withdrawn, straightened and re-introduced. In using the rectal tube to introduce fluids into the large intestines the tube is attached to a fountain syringe, thus allowing the liquid to pass slowly into the intestines.

SECTION XXXIII.
SURGERY OF THE EYE.

CHAPTER I.
PRELIMINARY CONSIDERATIONS.

Introductory.—Operations upon the eye and its appendages are the most delicate and the most exact in the domain of surgery. They require the greatest steadiness of nerve, deftness of manipulation and certainty of purpose on the part of the operator, and their necessary nicety may be estimated from the fact that nearly all of them are made upon tissues lying within the space of little more than a cubic inch. The difference of half a millimeter, or less, in the position of an incision, or of two or three degrees in its direction, may make the difference between the restoration of vision and its entire loss. Baron de Wenzel is reported to have said that he spoiled a hatful of eyes in learning to extract cataract, but probably no operator of the present day would be willing or able to make a similar declaration. The opportunities of study are now so ample, and the progress of ophthalmic surgery has been so great, that there could be no excuse for such a criminal experience. Yet it is true that no amount of practice upon pig's eyes in an operating mask can fully take the place of actual clinical experience. One may have extracted a score of lenses in this fashion, may know to a hair's breadth where to place the incision, and may be familiar with the smallest detail of the subsequent steps of the operation, but the novelty and importance of his first operation upon a living subject, and the sense of personal responsibility for the results to be obtained, may combine to give it so new an aspect that his nerves are unsteadied and his success jeopardized.

The general principles that govern operations upon the eye are those which obtain in operative surgery at large. It goes without saying that the operator should be entirely familiar with the surgical or relational anatomy of the eye and its appendages. Boldness and steadiness are only to be obtained by the possession of this knowledge. Operations upon the living subject should be preceded by careful and diligent practice upon the eyes of animals. The pig's eye is the most convenient and practical for this purpose. It is nearly enough like the human eye to render the operations upon it quite similar; and it is so easily obtained that there is always an abundance of material accessible. The eyes should be taken from the animal as soon as possible after it has been slaughtered, and should be used at once. If they have been frozen they are useless. A little ingenuity will suffice to construct something that will hold the eyes

firmly while operating upon them; or a "phantom" or "mask" for the purpose may be purchased at any instrument maker's. Muscle operations may be made upon the eyes of sheep or small animals left in their sockets. In addition to the necessary anatomical differences dead animal eyes do not have the same resistance as living tissue; and in spite of diligent practice it may be the student will have to educate his sense of touch over again, to some extent, when he comes to operate upon the living subject.

For most operations upon the eye it is important to have an assistant; for some, it is imperative. Where a general anesthetic is given two or three assistants may be required. It is better to have too many than too few. The use of cocaine makes it easy to dispense with help in the majority of operations. The patient may sit reclining or may lie down, and the surgeon may sit or stand, as is most convenient, assuming such a position beside or behind the patient as will make the use of his instruments most easy.

Antisepsis.—Owing to the small size of the wounds made in most ophthalmic operations, there is less liability to infection after an operation than in the wounds of general surgery. Moreover, wounds of the conjunctiva or cornea are covered and protected by the lids, which materially decrease this liability. Nevertheless the results of careful antisepsis in ophthalmic surgery are sufficiently good to warrant an insistence upon rational antiseptic methods. The use of germicides as a routine procedure in operations in the eye is, however, neither rational nor necessary. Germicidal agents which may be used with advantage or propriety upon other and grosser tissues of the body may be dangerous or destructive when applied to the delicate structures of the eye, or, if not dangerous, they may be too painful to be well borne by the patient. Careful laboratory experiments have shown that with the solutions in common use a much longer time is required to secure their germicidal effect than that in which they are usually in contact with the wound-area. Thus, in washing out the cul de sacs with a solution of bichloride of mercury nearly the whole amount used washes over the conjunctiva and cornea and runs away at once. What is left becomes immediately diluted by the tears which its presence occasions, to a very indefinite strength, and is carried away with them. Now constant contact with a solution of bichloride, 1:5000, for a period of three minutes is necessary to destroy the vitality of pyogenic bacteria, with Panas' solution two or three days, with carbolic acid, 1:40, $\frac{1}{2}$ to 1 minute, while boracic acid has no germicidal action whatever. As ordinarily used, then, these solutions have little more than a mechanical effect, so that any inert fluid would do as well. Furthermore, since the bichloride of mercury, even in very dilute solutions, has been shown to have in some cases an injurious action upon the cornea, any harmless fluid would be actually better. Normal salt solution (0.75 per cent sodium chloride in sterilized water) is absolutely safe and quite unirritating. Freely used it renders the surface of the cornea and conjunctiva practically sterile, and in practice has shown itself, in at least a certain range of operations, quite as valuable an "antiseptic" as the popular germicides. Where the germicidal agent can be left in contact with the tissues long enough to make its germicidal action possible, and where its use is not contraindicated for any reason, we may find some advantage in using chemical

germicides. They may be appropriately employed in operations upon suppurating tissues or upon the skin, for example.

Instruments should be bright and free from rust or roughness upon all portions coming in contact with the wound. They should be immersed for a few seconds in boiling water, made slightly alkaline with sodium carbonate, and wiped dry with absorbent cotton, or lint, or clean cotton or linen cloth, immediately before an operation. Some operators, after thus boiling and wiping, place the instruments in absolute alcohol for a few minutes, although this does not seem necessary. The use of boracic or carbolic acid solutions is superfluous.

Dressings are to be sterilized, preferably by heat, but in wounds of the conjunctiva or eyeball, which the lids naturally cover, it is not usually necessary that they be antiseptic.

Anesthesia.—Since the introduction of cocaine into ophthalmic surgery the use of a general anesthetic in operations upon the eye has become rare. Some plastic operations upon the lids, the removal of intra-orbital tumors, evisceration and enucleation are commonly done under chloroform or ether, as are also most operations upon young or intractable children. General anesthesia may be resorted to in cataract operations where the patient is unruly or lacks sufficient self-control; but, in general, the sphere of cocaine anesthesia is increasing, and includes, not infrequently, most of the operations above mentioned. The hydrochlorate of cocaine is employed in solutions varying in strength from one per cent. to ten per cent. of the drug in water; two per cent. to four per cent. solutions are those ordinarily used. These should be made in small quantities, and sterilized by boiling shortly before being used. By injecting a one per cent. or two per cent. solution beneath the skin, more or less deeply into the connective or muscular tissues, operations involving incision of the skin may be made painless. In ordinary operations upon the eyeball a two per cent. or four per cent. solution is employed; one or two drops are put in the lower cul de sac, or gently flowed over the site of the operation. If the use of the drug is begun fifteen minutes before the operation, and repeated every five minutes thereafter, making four instillations in all, as is often done in cataract operations, a long-lasting and comparatively deep anesthesia is produced. Between the instillations the eyes should be kept closed, to prevent the undue dryness and exfoliation of the corneal epithelium liable to result from cocaine. For a more profound anesthesia in operations involving the muscles and deeper structures injections of cocaine are sometimes made into the connective tissue about the globe near the seat of the operation. The use of cocaine by the methods above given is generally free from any danger whatever to the patient. Ordinarily there are no constitutional symptoms appreciable, but alarming indications of poisoning have been reported in a few cases, where marked cardiac depression and other profound symptoms have been observed. In view of the possibility of such evil results, even though remote, it may be laid down as a cardinal principle in the use of cocaine to employ the smallest quantity of the drug that will produce the necessary anesthesia.

Instruments.—The use of instruments in ophthalmic surgery is not essentially different from their use in general surgery. The instruments themselves, however, are much more delicate, more carefully made,

and usually with better cutting edges. Those that are used to penetrate the eyeball, for example, are given as keen an edge and as sharp a point as can be given to any cutting instrument. Most operators are very choice of their cataract knives and keratomes and will not allow them to pass out of their own hands except to the instrument maker. So important is it in the extraction of cataracts that the knives used should possess the best possible edge that many surgeons will use them only once without re-sharpening. The points and edges of knives may be tested upon the hand, or, better, upon a testing-drum covered with very soft kid, such as perfumers use to cap their bottles with. Gold beaters' skin may also be used for the same purpose, but is less satisfactory. A knife properly sharpened should enter and cut through the leather upon the drum by its own weight. It is well to examine a knife under a magnifying glass to see if its edge is uniform and straight. Ophthalmic instruments should be as small and light as is consistent with the requisite strength and balance. It is a common fault with scissors and forceps that they are clumsily made. Forceps should close with just enough resistance to enable the fingers to hold them securely. If the spring is too strong they are too fatiguing, while if too weak, especially if the forceps are small, they are difficult to hold. Yet forceps should not be too delicate. The blades in themselves must be substantial enough to insure perfect apposition of the teeth when closed. If they are too delicate a slight twist of the fingers will throw the teeth out of apposition. Scissors should bite evenly along the entire cutting surface of the blades. Their sharpness may be tested by cutting a piece of wet tissue-paper or absorbent cotton. They should cut uniformly and completely to their very points, and should not pull out or retain a small piece of the paper or cotton when thus tested.

For most operations upon the eyeball one or both eyelids must be drawn out of the way. This may be done by the fingers, by retractors or by a speculum. (Fig. 996). If the operator has a well-trained assistant, whose fingers are not too large, separation of the lids with the fingers is a very satisfactory method. The tips of the fingers must be applied at the edge of the lids and the force exerted to open them should be tangent to



Fig. 995. Lid Retractor.

the eyeball at the point of contact. In many instances the operator separates the lids with the fingers of his left hand while he operates with the right. Where the eyes are deeply sunken, where the palpebral opening is small, or where there is much blepharospasm, a lid-elevator or a speculum is more useful. The lid-elevator or retractor gives the patient very little inconvenience. In the hands of a careful assistant no hurtful pressure need be applied anywhere and the eyeball may be better exposed and with more comfort to the patient than by any other means. It is particularly useful in operations under cocaine, where the pressure of the ordinary spring speculum, if not painful, is at least disagreeable. One of the advantages of the use of the fingers and the elevator is the ease and rapidity with which the eyeball may be closed, if circumstances require that this be done quickly. The speculum is the instrument most commonly used to separate the lids. It dispenses with one assistant and is usually easily managed. Most simple in construction is the common

spring speculum. Noyes' speculum is an excellent one (Fig. 997); so is Stevens' (Fig. 996), and perhaps any one of a half-dozen others. It is better for an operator to decide just what form of speculum suits him best

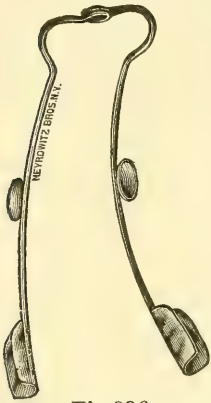


Fig. 996.
Stevens' Speculum.

and then to use it exclusively. In fact, it may be laid down as a general rule that an operator should become absolutely familiar with his own instruments and should, whenever possible, use them in preference to any others; for the most skillful use of tools, of whatever sort, comes only by familiarity with them, and one may make a bungling operation simply from using an unfamiliar needle-holder or fixation forceps. There is such a delicate sense of touch and weight in one's fingers, and a sort of local memory there, that they are quick to take note of unfamiliar scissors or forceps and are easily made awkward by them. Of course, the surgeon may make

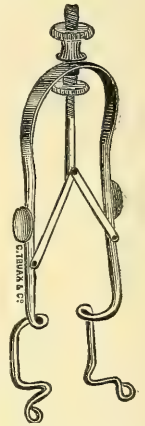


Fig. 997.
Noyes' Speculum.

successful operations with any instruments, dull or sharp, heavy or light, familiar or unfamiliar; but the key to expertness and artistic finish lies in the use of familiar and proper instruments and there is no question that here, at least, is one secret to the attainment of the highest results.

Fixation of the eyeball is usually necessary, and is commonly made by means of fixation forceps. (Figs 998, 999). It is

a matter of individual choice whether these are provided with a spring catch or not. Having grasped the conjunctiva at a point either opposite to the place of incision or a little to one side, gentle but firm traction is made in a direction nearly tangent to the globe, and with as little pressure as possible upon it. The hand should usually be allowed to rest upon some convenient portion of the face, to insure greater steadiness. Sometimes, to avoid bruising or tearing the conjunctiva, the fingers may be used to steady the eyeball, but they render the liability to infection greater. Various forms of hooks and ophthalmostats have been devised for fixating the eyeball, and may occasionally be useful; but they are apt to become tangled in the loose conjunctiva and are difficult to disengage.



Fig. 998.
Straight Fix-
ation For-
cep.

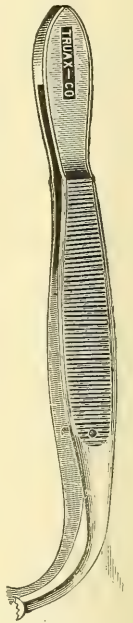


Fig. 999.
Curved Fix-
ation For-
cep.

Dressings, Bandaging, etc.—The growth of antiseptic surgery has brought the sponge into bad repute. It is accordingly found that it has been replaced, for the most part, by some aseptic absorbent, such as absorbent cotton, gauze, wood-wool, or lintine. In plastic operations upon the lids, where there is much hemorrhage, sponges properly cleaned and disinfected may be found useful or necessary.

Where sutures are required, a very light quality of silk, usually black, is commonly employed ranging, in fineness from A or B to OOOO. This thread may be bought upon spools or on cards, and should be sterilized before using. The finest thread is best used waxed, to prevent it from unwinding and tangling.

Bandages are required after many ophthalmic operations. They are usually of flannel or cheese cloth, from one and one-half inches to two and a half inches in width, and from three and a half to four and a half yards in length. Black cambric makes a less unsightly bandage for ambulatory patients. A pad of some soft material is used over the eye as a compress. This may consist of several pieces of lint laid loosely together, or the eye may be covered with a single disc of lint and absorbent cotton laid upon this in such a manner as to make even pressure around the globe but not upon it. The simplest form of bandage is the oblique retaining bandage. This is used where the compress must be changed frequently, or where it is not important that the compress be held in an exact position. Instead of a roller a handkerchief may be used; and for office operations this constitutes a very useful dressing, because it is less unsightly than the roller bandage. The common retaining bandage, Fig. 1000, is applied as follows:

Starting with a single complete turn around the head, to the right for the left eye and to the left for the right eye, the roller is then carried around the occiput, under the ear and over the nasal side of the orbit to the middle of the forehead, where it is pinned along its lower border (or both lower and upper) to the first turn of the bandage; a downward turn of the roller is made, and it is again carried in a line with the bandage already in place, around the opposite temple, under the occiput and ear, is brought up over the temporal side of the orbit, and is pinned along its upper border (or both upper and lower); if necessary, another turn of the roller is made and it is carried around as before, this time coming up over the middle of the orbital space. After pinning the last turn upon the forehead the end of the bandage is carried to the side of the head and made fast with a small safety-pin.

If the bandage is to make pressure around and not upon the eyeball, as after cataract operations, the first turn passing over the eye should be made taut and pinned along its nasal border only, the second turn made taut and pinned along its temporal border only, and the last turn tightened uniformly but gently, and pinned either along both borders, or in the middle.

In this way, providing the compress is properly adjusted, the eyeball may be made to receive nothing but a gentle and uniform pressure,



Fig. 1000.

Retaining or Compress Bandage for One Eye.

so long as the bandage is undisturbed. If a pressure bandage is desired the uniform tension of all the turns of the bandage, pinning them in the middle, will answer. Often two turns of the bandage are enough. It is understood that before applying the bandage a proper compress or covering is placed over the eye. In case it is desired to apply this bandage to both eyes (Fig. 1001) a longer roller should be selected, and after making the first turn over one eye fast to the forehead instead of carrying it around the head again it is carried at once downward over the other eye, around the back of the head or neck, up over the first eye, pinned to the forehead again, and then down over the other eye, etc., a final turn being made completely around the head to assist in holding the ends in place. Some operators in cataract operations, iridectomy, etc., have discarded the roller bandage and use a strip of the softest and thinnest silk isinglass plaster, about a half an inch wide, and extending from the middle of the upper lid downward upon the cheek, leaving a little space at either side for the escape of tears or the admission of atropine, eserine, etc. This is a very rational and satisfactory dressing where it is not necessary to examine the eye frequently, or to use moist



Fig. 1001.

Retaining or Compress Bandage for Both Eyes.

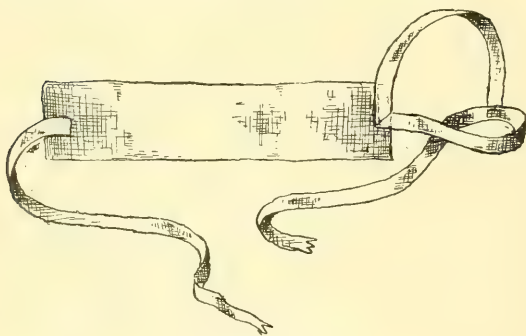


Fig. 1002

Liebreich's Bandage.

each end, as shown in Fig. 1002, so that it may be removed and put in place without the patient's raising his head from the pillow.

applications. A light compress may be laid over the plasters and held in place by an oblique bandage or by strips of adhesive plaster passing over it, from the forehead to the cheek. The Liebreich bandage is also very satisfactory. It consists of a piece of knitted cotton (a piece of stocking-leg will answer) about a foot long and two and one-half inches wide. Tapes are fastened to

CHAPTER II.

INJURIES AND DISEASES OF THE ORBIT.

Injuries.—These are usually due to the lodgment of foreign bodies in the orbit, from penetrating wounds, or from contusion. These may occasion fracture of the orbital walls, penetration or rupture of the eyeball, laceration of the muscles or optic nerve, or hemorrhage into the orbit, and may give rise to orbital cellulitis, abscess, necrosis, and sometimes fatal meningitis.

TREATMENT. Foreign bodies, when they can be found, must be removed, and all wounds thoroughly cleansed and disinfected. If cellulitis occur iced compresses continuously applied, and rhus, aconite, arnica, ledum, hepar, silicia, or mercurius given internally as indicated will be useful. In event of suppuration taking place the abscess should be opened at the most accessible point and treated as other abscesses are.

Diseases.—**TUMORS.** These may be primary or secondary by extension from the eyeball or superficial structures. They may involve the connective tissue or blood vessels of the orbit, the optic nerve and muscles, or the orbital walls. Primary growths may be sarcomatous, osseous, angiomatous, cystic, etc. Secondary growths are usually either sarcoma or glioma from the globe, or carcinoma from the superficial structures. They may cause protrusion and displacement of the eyeball, resulting in blindness and immobility, and may simulate abscess or cellulitis. The history of the case and careful palpation of the orbital contents generally suffice for their diagnosis.

Treatment is usually surgical. The incisions for their removal may sometimes be made through the conjunctiva. Where an incision through the lid is necessary it should be made in the direction of the fibres of the orbicularis muscle, to avoid scar. Where the growth does not involve the optic nerve or the muscles it may often be removed without injury to the eyeball or to the vision, although care must be taken not to wound these structures. If there is no pressing danger from the presence of the tumor the use of so-called antipsoric remedies may be tried; but these should not stand in the way of surgical measures if the condition is an urgent one.

ORBITAL CELLULITIS. This may result from wounds or foreign bodies in the orbit, operations on the eye, necrosis of the orbital walls, severe constitutional disease, such as erysipelas, or it may arise without appreciable cause. There is usually much pain, the lids and conjunctiva are swollen and edematous, the globe pushed forward, and there may be such constitutional disturbances as chills and fever. The pressure within the orbit may give rise to immobility of the globe and loss of vision, with or without optic neuritis. Suppuration frequently takes place, and an abscess forms. The history of the case and the symmetrical exophthalmos will generally serve to distinguish it from orbital tumor.

Treatment consists in the use of iced compresses, apis, aconite, rhus,

hepar, etc., in the acute stage. If pus forms it should be evacuated through an incision in the conjunctiva where practicable, or through the skin by means of an incision parallel to the margin of the orbit, and the abscess treated antiseptically. Where the exophthalmos and edema are very great a canthotomy may be made as a preliminary operation. Sometimes a deep incision into the orbit, even before pus has formed, may give much relief. Most cases of orbital cellulitis recover; many are accompanied with loss of vision, and in some cases a fatal issue occurs from meningitis.

ORBITAL PERIOSTITIS. This may arise from traumatism or from certain conditions of the system, such as tuberculosis, syphilis and rheumatism. The symptoms are similar to those of cellulitis. The exploring finger may detect some exquisitely sensitive spot along the orbital edge when the trouble is not too deep. The affection may become chronic.

Treatment consists in hot applications, rest, with kali jodatum, silicia, or mercurius. If the disease becomes localized an exploratory incision may be necessary. If an abscess forms it should be evacuated and treated as usual. Sinuses should be kept open by packing or by tents, cleansed daily with injections of warm sterilized water or chlorine water, 1:100, and thoroughly drained. If rough bone is detected on probing its forcible removal is not to be attempted, except that perhaps loose spiculæ or particles of bone may be taken away if easily dislodged. If symptoms of meningitis occur the diseased bone should be exposed, cleaned or removed and thorough drainage established. The patient's general health must be carefully looked after. The prognosis is to be guarded, while remedies suitable to bone diseases should be given as indicated. Drugs may act beneficently where the knife is powerless.

CHAPTER III.

THE EYEBALL.

Injuries.—Injuries may be from blows, wounds of various sorts, and burns. Blows upon the eye may cause hemorrhage into the anterior or vitreous chambers without other appreciable lesions; separation of the iris from its peripheral attachments; partial or complete dislocation of the lens; cataract; rupture of the globe, or of the retina or choroid. Hemorrhage into the anterior chamber, causing immediate and great loss of vision, may be entirely absorbed, and normal vision regained in a few days. If the lens is dislocated under the conjunctiva or into the anterior chamber it will have to be removed through a suitable incision. Cataract will require for its removal either discission with a needle, in subjects under twenty, or extraction in older patients. (See Cataract.)

WOUNDS. The globe may be wounded with a great variety of missiles and in innumerable ways. The extent of the injury is often not to be made out when the eye is first seen, and it is not always safe to make a bad prognosis even in an apparently hopeless injury. The general treatment includes the use of irrigation with normal saline solution or with some mild antiseptic, such as chlorine water, bandaging, atropine, or should the iris prolapse, eserine, hot or cold applications, calendula or arnica compresses, rest and the indicated remedy. Clean, incised wounds of the cornea, where there is no prolapse of the iris, usually need no other attention than a light compress and instillations of atropine or eserine, according to circumstances. If the iris prolapses into the wound the attempt may be made to replace it within the anterior chamber with a small spatula, and to keep it in place by the use of eserine sulphate (one-fourth or one-half grain to the ounce, one drop in the eye every three or four hours). or by means of the myotic action of morphia, one-fourth grain given hypodermically. Failing in this, the prolapse may be grasped with the iris forcep, drawn slightly out through the wound, and cut off close to the cornea with curved scissors. If any portions of the iris remain incarcerated in the wound they should be gently pushed back into the anterior chamber with the small spatula. (Fig. 1003). Where the lens has been penetrated by a sharp instrument or foreign body cataract will follow and the lens may swell so greatly as



Fig. 1003. Eye Spatula.

to necessitate its partial or complete extraction. In such injuries atropine should be used freely. When a foreign body has penetrated the cornea and is lodged in the iris it may sometimes be removed with a curette or forcep through a linear incision in the cornea; but it will often be necessary to make an iridectomy, removing the foreign body and that portion of the iris in which it is embedded. Wounds of the ciliary region are dangerous from the liability of ensuing sympathetic ophthalmia. Foreign bodies in the cornea may be removed under cocaine, by means of a sharp-pointed needle or

a spud, the needle being used by preference. (Figs. 1004, 1005). If a sharp splinter of metal lies in the cornea so that any attempt to remove it is likely to drive it through into the anterior chamber, a broad needle may be



Fig. 1004. Iris Needle.



Fig. 1005. Dix' Spud.



Fig. 1006. Discission Needle.

passed through the cornea at one side and brought up behind it, so as to push it forward and prevent this accident. (Fig. 1006). Sometimes a small particle upon the corneal surface may be wiped off with a bit of cotton, wound on the end of a match or tooth-pick, or a loop of hair may be used as a snare. A magnifying glass is of great assistance in the removal of these small bodies, and a condensing lens to improve the illumination may be useful. Foreign bodies on the cornea are most readily seen by observing them in the reflection of a window or large flame. Care must be taken not to mistake small spots of pigment on the iris for particles upon the cornea.

If a foreign body in the vitreous can be located an incision may be made in the sclera over it and it may be grasped with small forceps, or if composed of iron or steel it may often be secured and removed by using the electro-magnet. In using this instrument the strictest anti-septic precautions should be observed. If a foreign body has entered the globe and cannot be removed it is best to eviscerate or enucleate the eyeball, to guard against sympathetic inflammation of the other eye. If there is any question as to its presence in the eye, inasmuch as small, swiftly-moving particles sometimes pass entirely through the globe, conservative measures may be more properly adopted and the operation deferred until its urgency is more evident.

ENUCLEATION OF THE EYEBALL. The patient is usually anesthetized. After inserting the speculum the conjunctiva is grasped with forceps and by means of a pair of curved scissors is separated from the globe close to and entirely around the cornea. It is then dissected from the globe as far back as the equator. The superior rectus muscle is lifted upon a strabismus hook and severed with scissors near its insertion. The other recti muscles are then likewise lifted and severed in turn. With the fingers or a sharp hook the eyeball is drawn forward between the lids toward the temporal margin of the orbit. A pair of strong curved scissors are then passed along the inner side of the globe until the optic nerve is felt; their points are then opened and the nerve is divided as far back as is necessary. The eyeball is dragged still further forward and the oblique muscles, as well as any other adherent tissue, are severed with the scissors. Firm pressure is then made upon the orbit to stop the bleeding. The conjunctiva is brought together with either the tobacco-pouch or interrupted suture and the eye dressed antiseptically. The reaction is usually only moderate.

EVISCEATION. This is applicable in place of enucleation in all cases except those in which there are malignant intra-ocular growths. The patient is anesthetized and with the speculum in place an incision is made along the edge of the cornea and with a Von Graefe or Beer's knife (Fig. 1007) and a pair of scissors the entire cornea is cut off, just in front of

the iris. The contents of the globe are now scooped out with a sharp spoon. Bleeding is free. The sclera must be left perfectly clean over its entire inner surface, except for the blood clots which naturally remain. The globe is washed out with a sublimate solution, 1:5000, and a tobacco-pouch suture used to close the wound.

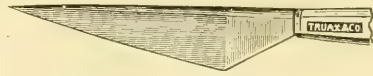


Fig. 1007. Beer's Knife.

Reaction is often very severe, and considerable chemosis of the lids may appear on the second or third day. This should be treated with iced compresses, with *rhus*, *apis* or *belladonna* internally. The value of this operation is the superior mobility of the stump left for an artificial eye. There is also less falling in of the lids.

The prognosis after enucleation and evisceration is usually good, but fatal cases of meningitis have been reported, particularly after operations for panophthalmitis.

OPTICO-CILIARY NEURECTOMY. This operation consists in passing strongly curved scissors through an incision in the conjunctiva between the superior and internal rectus muscles to the optic nerve, and simply either cutting it and the ciliary nerves deep in the orbit, or, after severing these structures, dragging the globe around so as to expose them to view and resecting them close to the eyeball. The reaction is severe, and the operation is not much resorted to. Its chief sphere of usefulness is in the relief of pain in absolute glaucoma, and in those cases in which the patient absolutely refuses enucleation or evisceration.

ARTIFICIAL EYES. They may be worn after enucleation or evisceration or upon a shrunken stump which is not irritable or sensitive. Right and left eyes differ in shape. A good fit is sometimes difficult to obtain. In inserting eyes they are first moistened and the large or temporal side is slipped vertically up under the upper lid, the eye is then turned into position, and the lower lid pulled down until it slips over its lower edge. They must be removed at night and frequently washed with water or alcohol. If properly fitted they cause neither pain nor discomfort. They may be removed by drawing down the lower lid and inserting a small hook or the head of a large pin under their lower border.

Sympathetic Ophthalmia.—It is well known that certain injuries and diseases of one eye are prone to set up diseased conditions in the other eye, owing to the intimate connection which exists between the two eyes. Inflammation which is transmitted in this way from one eye to the other is called, in general, sympathetic ophthalmia. Its diagnosis is of great importance. It may be caused by or have its starting-point in foreign bodies in the globe, injuries and diseases of the ciliary body, incarceration of the iris in a corneal wound, operations upon the eye, or from panophthalmitis. The immediate state of irritation or inflammation to which any one of these causes may give rise may be adequate to the sympathetic establishment of one or more of a series of symptoms and conditions in the previously sound eye, tending almost universally toward blindness. It is the malignant nature of these sympathetic affections which makes their recognition of so much importance. What the exact nature of the process is by which certain inflammations are carried from one eye to the other cannot be absolutely stated. There is evidence going to show that it is sometimes the transmission of material germs along

the lymph channels between the two eyes, and that sometimes it is a form of irritation transmitted along the ciliary nerves.

The following diseases may be sympathetic in their origin: ciliary neuralgia, irritation of the retina or optic nerve, retinitis, choroiditis, optic neuritis, cyclitis and iritis. Sympathetic disease is always to be suspected where one eye is blind from injury or inflammation and the sound eye shows ciliary congestion, tenderness, periodical blurring, temporary or permanent reduction in vision, various subjective sensations, such as flashes of light, scintillations, scotomata, or inflammation of any of the internal structures, and the surgeon will be warranted, when any of these symptoms are present, in proceeding upon the belief that they are sympathetic in character, and in treating the patient accordingly.

TREATMENT. The prime indication for treatment in cases of sympathetic ophthalmia is to remove the cause. Since the cause lies in a diseased condition of the exciting eye this should be removed if possible. Ordinarily, the only remedy is the radical removal of the offending eyeball by enucleation, or of its contents by evisceration. Whatever is done should be done thoroughly, and without delay. Differences of opinion exist as to the proper course to be pursued in sympathetic inflammation from panophthalmitis. In enucleating or eviscerating an eye affected with this form of inflammation there is danger of meningitis following the operation. It has been done safely, however, many times, and the operator may have to decide between total blindness and a possible meningitis, a risk which most patients would be willing to run. The method of performing these operations has already been described.

CHAPTER IV.

INJURIES AND DISEASES OF THE LIDS.

Injuries.—Injuries of the lids may be due to incised, lacerated or punctured wounds, blows or burns. They are apt to cause deformity, particularly when they involve the border of the lid or the tarsal cartilage. They are to be treated like similar injuries elsewhere. Wounds should be closed accurately, and fine sutures used to prevent scar. Notches or fissures in the edge of the lids should have their edges freshened and the wound united with sutures or with a pin and twisted suture.

Ectropion.—A frequent result of burns, it may also arise from inflammatory thickening of the conjunctiva (of the lower lid), lax lids in elderly persons, or from caries of the edge of the orbit, causing adhesion of the skin. The treatment varies with the character and severity of the affection. Very mild cases, dependent upon slight cicatrices, may be benefited or even cured by persistent and long continued

traction upon the scar by the patient himself. Frequent stretching and pulling will loosen the adhesions and enable the lid to resume its normal position. Usually an operation is necessary. If the ectropion is due to a simple hypertrophy of the conjunctiva a strip of this membrane along the lid, corresponding in width with the amount of eversion, may be excised, or this procedure may be combined with the removal of a V-shaped piece of the outer extremity of the lower lid if a greater effect is desired. The conjunctival wound is not closed with sutures. In

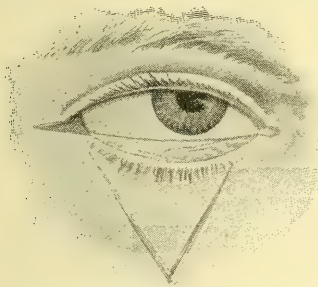


Fig. 1008. The V Y Operation for Ectropion, Showing Lines of Incision.

cases arising from cicatricial contraction the important indication is to operate in such a manner that, first, the normal contour of the lid may be restored; second, that deformity may not be re-established by traction from the resulting scar when healing takes place. The endeavor to fulfill these indications has led to the invention of a great variety of operations. For very slight cases what is called the V Y operations, shown in Figs. 1008 and 1009, may be resorted to. The edges and tip of the triangular flap are undercut sufficiently to permit the lid to be drawn up into position. The lower edges of the wound are loosened freely and the sutures inserted as indicated in the figure. This operation in itself may be sufficient; but if the border of the lid has become elongated the redundant portion may be excised from the lid border at its outer

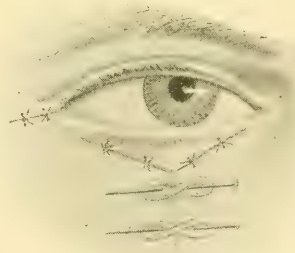


Fig. 1009. The V Y Operation for Ectropion, Showing Method of Suturing.

extremity, and a V-shaped incision made in the skin at the outer canthus, the wound being united as illustrated. Only a very limited inversion of the lid can be secured by this operation. Its use is therefore restricted to the mildest cases.

The excision of a triangular wedge from the middle of the lid, including the skin (Adams), is not to be recommended, owing to the scarring it produces. A better operation for the same purpose is that of Kuhnt-Mueller; see Figs. 1010 and 1011.

The lid is split along its intermarginal space by an incision parallel to its surface, for a distance about twice that of the triangular piece of cartilage to be removed. The resection is made, and the sutures are placed as shown in the figure. When the deformity is considerable and there is much scar-tissue upon the lids a plastic operation is necessary. The cicatrix is excised and the surrounding skin undermined sufficiently to enable the lid to resume its normal position. In order to prevent the eversion from becoming re-established the edges of both lids may be freshened and united with sutures, thus

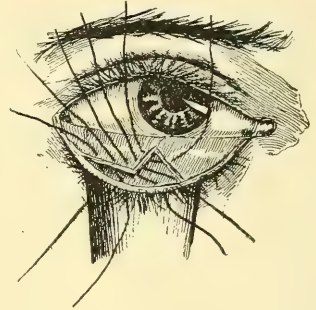


Fig. 1010.
Kuhnt-Mueller Operation for
Ectropion.

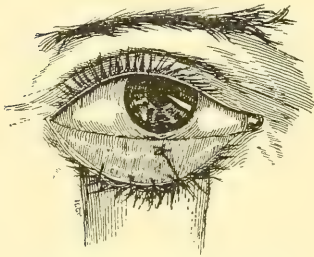


Fig. 1011.
Kuhnt-Mueller Operation for
Ectropion.

making what is called a provisional tarsorrhaphy; or sutures may be passed through the edge of the lid so that it may be bodily lifted up and put upon the stretch, the ends of the threads being fastened by means of adhesive plaster to the forehead, if the operation is upon the lower lid, or to the cheek, if upon the upper lid. Skin grafts, preferably those of Thiersch, may now be placed upon the raw surface and the eye dressed antiseptically. In order to secure the most perfect results the lids may be left

united along their edges for several weeks after the wound has healed. The operation of Dieffenbach, shown in Fig. 1012, is a type of those in which sliding flaps are used. A flap is dissected up and transferred to cover the space where the skin and scar tissue have been removed from this area. Extensive deformity from burns, or after the removal of tumors, will require blepharoplastic operations more or less ingenious. Even the whole lid may have to be restored, the flaps be taken from the forehead, temple or cheek, Thiersch grafts, or the bodily transplantation of skin from distant parts of the body may have to be resorted to.

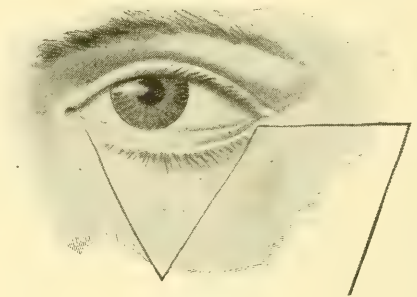


Fig. 1012.
Dieffenbach's Operation for Ectropion.

Trichiasis.—That condition of the lids in which without involvement

of the tarsal cartilage the lashes are faulty in position or shape, being inverted so that they are brought into contact with the cornea in the act of winking. A common designation of the condition is "wild hairs." When the faulty lashes are few they may be destroyed by electrolysis. A fine jeweler's broach in a suitable handle is connected with the negative pole of a galvanic battery, and is introduced by the side of the hair through the duct to its follicle. A sponge electrode connected with the positive pole is placed upon the skin of the cheek near by, and a current of from ten to fifteen cells is then passed through the electrodes until a ring of foam or froth appears about the base of the hair, which is then easily removed with forceps. The operation is somewhat painful. Trichiasis merges into entropion so gradually that it is not always possible to distinguish them. In entropion there is always incurvation of the tarsal cartilage, and the inversion of the lid is in itself sufficient to produce irregularities in the growth and position of the lashes. Entropion and trichiasis are caused by blepharitis, burns, trachoma, or, in senile entropion, from relaxation of the tissues and spasmodic action of the orbicularis. Spasmodic entropion may be caused by irritation from chronic keratitis.

In partial trichiasis the following operation (Arlt-Jaesch-Waldhauer) is useful. It is applicable to either upper or lower lid. An assistant puts the lid on the stretch by means of a lid spatula and an incision is made in the inter-marginal space back of the faulty lashes (i. e., between the lashes and the inner edge of the lid), extending a little to each side of them, and carried into the substance of the lid 3 or 4 mm., splitting it into two parallel layers; the anterior containing the errant lashes, the posterior the Meibomian glands and their orifices. A crescentic flap of skin of sufficient size is then excised from the surface of the lid and near its margin opposite the incision already made. The edges of the wound in the skin are then brought together with sutures, so that their traction everts the anterior edge of the lid, bringing the lashes into their proper position. The flap which is removed is trimmed to the proper size and placed in the gaping wound in the border of the lid to maintain the eversion of its edge. It does not need to be held by sutures. This operation is also applicable in entropion, in which case the lid is split into two layers by extending the inter-marginal incision along its entire edge from the punctum to the outer canthus, and a correspondingly long skin flap is removed. The results are better, however, in partial trichiasis.

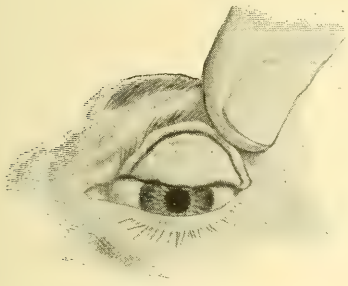


Fig. 1013.

Green's Operation. Line of Incision through Tarsus.

Entropion.—Senile entropion is easily distinguished. It needs only the excision of a strip of skin, or skin and muscle, 2–3 mm. in width, along the lid, parallel to and very near its margin, and the closure of the wound with sutures.

Scores of operations for entropion have been devised. Among the best is that of Green. The lid having been inverted upon a spatula (Fig. 1013), an incision is made upon its conjunctival surface, parallel to its margin,

and $2\frac{1}{2}$ –3 mm. distant from it (i.e., just back of the Meibomian glands), through the cartilage and extending the entire length of the lid. The muscle and overlying skin are not cut. The incision may be made with a round-bellied scalpel, or with scissors, after making a small opening with a knife for their admission. A strip of skin, seldom exceeding 2 mm. in width, situated about 1 mm. back of the line of the lashes, and extending along the entire border of the lid, is then excised and sutures are inserted, either simply to bring the edges of the skin together, or where more effect is required, in the manner shown in Fig. 1014, three or four sutures may be used. The threads are loosely tied to avoid constricting the included parts, and are removed twenty-four, or at the most forty-eight hours after the operation. The lashes may be turned back upon the lid and painted with collodion, to secure greater eversion. Often the under incision of the tarsus is sufficient, without the excision of the skin or the use of sutures. If the amount of eversion secured by one incision is not enough, a second one, parallel to the first, and a few millimeters back of it, may be made at any time. The results of this operation are very satisfactory.

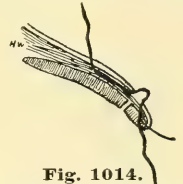


Fig. 1014.
Green's Operation.
Vertical Section
through Upper Lid,
Showing Manner of
Inserting Suture.
The Thread Is Rep-
resented by the Con-
tinuous Wavy Black
Line.

Operative Measures.—Canthotomy and canthoplasty are operations whose indications are encountered when it is considered desirable to increase the size of the palpebral opening for any reason.

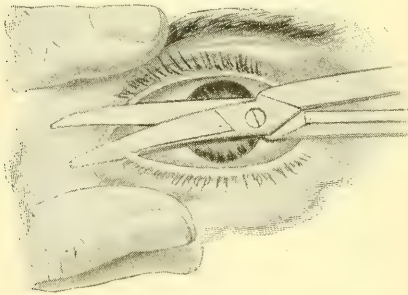


Fig. 1015.
Canthotomy.

CANTHOTOMY. This operation is (Fig. 1015) made when the enlargement is to be temporary. The lids at the outer commissure are put upon the stretch and drawn inward by vertical tension upon them with the fingers. A pair of straight or curved scissors is then introduced, one blade within, the other without the commissure, and the skin and underlying tissues, including the palpebral ligament, are then divided in a line following the natural

folds of the skin when the lids are closed, as far as the orbital margin. Bleeding is free, and ordinarily need not be checked. The eye is dressed with a light compress. The operation may be made subcutaneously if desired.

CANTHOPLASTY. This consists in making an open canthotomy as above, and then uniting the skin and conjunctiva by means of three sutures; one at the outer angle, and the others near either end of the wound. In this way the opening of the lids is permanently somewhat enlarged.

Hordeolum.—Stye is a common affection of the lid due to blepharitis, eye-strain, or nasal catarrh, favored by some constitutional predisposition.

TREATMENT. Internal administration of remedies, pulsatilla, staphisagria, hepar, thuja, sulphur, may help to abort an attack, or to prevent recurrence. Ice or warm compresses and an early incision when pus forms are proper measures. Eye-strain of any kind should be relieved.

Chalazion.—This is a small tumor originating from obstruction and distension of either the follicles of the tarsus or the Meibomian glands. Its contents are usually fluid.

TREATMENT. Sometimes these tumors disappear spontaneously, or under the action of thuja given internally and applied locally by rubbing with the finger. They are best removed by excision through the skin. A hypodermic injection of cocaine, one per cent. or two per cent. solution, is made in the vicinity of the tumor. The lid is held in an appropriate

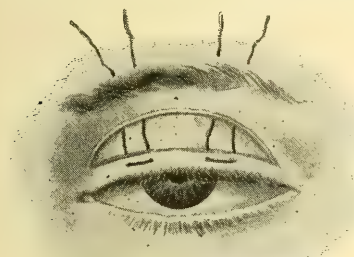


Fig. 1016. De Wecker's Operation for Ptosis, Showing Flap of Skin Excised and Method of Inserting Sutures.

clamp, such as Knapp's or Desmarre's, to prevent bleeding during the operation, and an incision is made over the tumor through the skin, parallel to the edge of the lid, 8–10 mm. in length. The cyst is grasped with forceps, after it has been dissected into view, and cut out. No harm is done if the cartilage is cut into, or slightly buttonholed. After the clamp is removed and bleeding has ceased the wound is closed with a fine suture or with court-plaster. No bandage is necessary. Evacuation of the tumor through a conjunctival incision, scooping out its contents, and packing with cotton for twenty-four hours sometimes result in cure, but are often followed by a reappearance of the growth. A hard nodule is usually left for a few days or weeks in the site of the growth and is gradually absorbed.

Epicanthus.—A condition of redundancy of the skin at the inner canthus, forming a vertical fold at the inner angle of the eye.

TREATMENT. This consists in excising an oval flap of skin from the bridge of the nose, its long axis vertical, undercutting the edges of the wound, and bringing them together with sutures.

Ptosis.—A drooping of the upper lid due to inflammatory thickening of the lid, relaxation of the tissues, or paralysis of the levator.

TREATMENT. In recent cases much may sometimes be accomplished by electricity (the secondary or interrupted galvanic current) and the administration of internal remedies. Of the latter causticum, rhus, gelsemium, conium and kali iodatum are the more important. In case the levator is paralyzed an operation may be performed to connect the tarsal cartilage with the frontalis muscle. De Wecker's operation is among the best: The upper lid is stretched between the fingers, and a crescentic flap of skin excised as shown in Fig. 1016. Two sutures are used, entering each needle just above the brow and passing it beneath the skin, close to the tarso-orbital fascia, until it emerges at the upper edge of the wound; then over the muscle and under the skin and muscle at the lower edge of the wound, bringing it out at the point shown; then at a point three millimeters distant, entering the skin and muscle, out at the lower edge of the wound, across the exposed muscle, under the upper edge of the

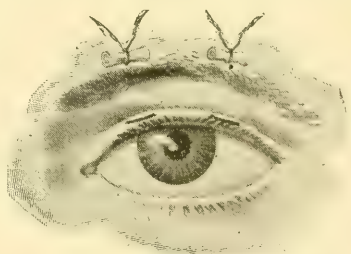


Fig. 1017. De Wecker's Operation for Ptosis, with Sutures Tied.

wound and close to the tarso-orbital fascia, until it emerges near the original point of entrance. The ends of each thread are now tightened and tied over a small roll of adhesive plaster (Fig. 1017). The threads are drawn up and tightened every day or two. In this way they will form subcutaneous cicatrices connecting the lid to the brow. If the operation has been done under careful antisepsis there will be no supuration in the track of the threads. They may be left in position as long as three or four weeks. The restoration of the functions of the lid is at the best imperfect, and some deformity will probably remain.

Blepharo-spasm.—Consists of spasmodic contraction of the orbicularis muscle. It is a frequent accompaniment of ocular inflammations.

TREATMENT. When persistent and severe, if pressure upon the supra-orbital nerve or upon other branches of the fifth nerve relieves, these nerves may, as a last resort, be divided or resected. In other cases, the cause is to be sought for and removed if possible. Agaricus is a valuable remedy in many cases.

CHAPTER V.

INJURIES AND DISEASES OF THE LACHRYMAL APPARATUS.

Injuries of the Orbit.—These may cause inflammation of the lachrymal gland, leading to abscess. Lacerated or incised wounds at the inner angle of the lids may divide the canaliculi and lead to their closure, so that the tears continually flow over the cheek.

TREATMENT. Abscess of the gland may be opened through the conjunctiva. If the canaliculi have been divided it is useless to attempt their reunion. Bowman's operation (see below) should be employed to establish a free exit of tears into the nasal duct.

Acute Dacryo-Cystitis.—An acute inflammation of the lachrymal sac, resulting from chronic catarrhal inflammation of the tear-passages, injuries, nasal catarrh, cold and similar causes. The lids may be greatly swollen, and there are the usual signs of a circumscribed inflammation. The canaliculi and the nasal duct become closed, and the inflammatory products accumulate until, if the disorder progresses, the abscess breaks through the skin over the sac, forming a fistula.

TREATMENT. If a fistula has not already formed, but seems imminent, a vertical incision should be made into the sac through the skin, and the abscess evacuated and treated by irrigation with calendula 1:10, sublimate 1:5000, hydrogen peroxide or other antiseptic. If the swelling of the lids is not too great, the canaliculus should be slit (Bowman's operation) and probes passed through the duct. Hot or cold applications, together with the indicated remedy internally, should be resorted to if there is any delay in the surgical treatment.

Blenorrhea of the Sac.—CHRONIC DACRYO-CYSTITIS, MUCOCELE. This is a chronic catarrhal inflammation of the sac and nasal duct, with stricture of the duct and the accumulation in the sac of mucus or mucopurulent matter which may be forced out through the puncta by pressure over the sac. More or less persistent lachrymation is also a constant symptom. It usually results from the extension of catarrhal inflammation from adjacent structures. Exacerbations may occur, giving rise to attacks of acute dacryo-cystitis. There is little or no tendency to spontaneous recovery.

TREATMENT. Consists in the divulsion of the strictures by probes, or their division with a stricture knife and attention to the catarrhal condition. As a preliminary to probing, Bowman's operation may be resorted to, although small probes may be passed after simply nicking or dilating the puncta, leaving the canaliculus intact.

BOWMAN'S OPERATION. One of the puncta, usually the lower, is stretched by means of a pin, or the point of a Weber's knife (Fig. 1018), and the probe-pointed blade of a pair of canaliculus scissors passed into the canaliculus as far as the sac. The overlying tissues are then divided

with the scissors, the lid being dragged outward with the finger. The incision should be placed so that it lies in the line separating the skin and conjunctiva. A Weber's knife may be used to slit the canaliculus,

but is less satisfactory than the scissors. This operation is usually preliminary to passing probes into the nasal duct, which may be accomplished as follows:



Fig. 1018.
Weber's
Knife.

PROBING THE NASAL DUCT. When there are acute inflammation and swelling and the parts are very tender the operation must be done under chloroform; but in other cases the patient use of cocaine, 4-10 per cent. solution, injected into the sac and duct with a lachrymal syringe, will so anesthetize the parts that little or no pain will be felt. The surgeon stands behind the patient for the right eye, and in front for the left. A small probe is entered along the divided canaliculus, in a horizontal direction, until its point enters the sac and meets firm resistance against the lachrymal bone. Keeping the probe firmly but gently pushed against the bony wall it is rotated into a vertical position with its concavity forward, and is pushed cautiously downward, slightly backward and outward, through the duct, until its tip has passed into the nose. Neither too much nor too little pressure should be used. If too much, there is danger of making a false passage, which although not necessarily a serious injury renders the proper treatment much more difficult and tedious. It is better to urge the probe slowly and carefully, for having once passed it through the duct the subsequent treatment of the case is comparatively easy. The passage of the small-sized probe may usually be followed by that of the larger ones up to number eight, or higher, at a single sitting. There may be a little bleeding into the nose after the probe has been removed, if a stricture has been broken up. The probes may be passed every other day or less often, according to circumstances, or a style of lead or silver, made to fit the duct, may be inserted and worn continually. In either case the passages are to be treated with antiseptic or astringent injections, such as the peroxide of hydrogen, sublimate solution, 1:5000, hydrastis 1:100, two or three times weekly, by means of a lachrymal syringe. The simplest syringe is a hollow No. 4 probe attached by a short piece of rubber tubing to an ordinary medicine dropper. The tip of the syringe should enter the duct, and the fluid injected should reach the nose easily.

The nasal or naso-pharyngeal catarrh, if present, should be treated with appropriate remedies. This is important to a cure of the duct.

The treatment of lachrymal stricture with blenorrhoea is almost always protracted, and is not always successful. Sometimes the best that can be done is to relieve the catarrhal condition, the epiphoria still persisting. The use of the probes and the details of the treatment are only to be learned by experience.

CHAPTER VI.

INJURIES AND DISEASES OF THE CONJUNCTIVA.

Injuries.—These are chiefly from foreign bodies and burns. Foreign bodies are usually removed without trouble. The lids should be everted and both palpebral and ocular conjunctivæ thoroughly examined, a few drops of a four per cent. solution of cocaine having been previously dropped into the eye. The upper cul de sac may be explored and wiped out with a probe armed with a bit of cotton or a soft cloth. Particles which are firmly imbedded may require removal with a sharp needle or spud. If the particles are numerous they may be washed away with warm water. Burns are subject to the general treatment applicable to such injuries. They are likely to cause contraction and deformity of the lids as well as adhesions between the lids and globe (symblepharon).

Symblepharon.—It may be partial or total and is difficult to cure. The apposing surfaces may be easily separated, but are prone to re-unite. Numerous plans have been suggested to prevent this, such as the insertion of a leaden or ivory plate. Such efforts are fruitless. The most satisfactory method is to transplant on to the raw surfaces, left after the adhesions are broken up, a flap of conjunctiva from the eye itself or from a rabbit's eye, or a Thiersch graft of proper size. Such grafting should be done under antiseptic precautions and the eye dressed with a sterilized dressing, which may be left undisturbed for three or four days if there is no special indication for disturbing it earlier. By these methods at least a partial restoration of the parts may be looked for. Except where the symblepharon consists of small connecting bands of cicatricial tissue, beneath which a probe may be passed, there is little use in attempting to relieve this affection without undertaking some form of plastic operation. Where such narrow bands alone exist they may be cut off close to the eyeball, and the neighboring conjunctiva, having been undermined, is drawn together and sutured over the raw surface. That portion of the band attached to the lid may be then cut away, or its removal left until later.

Anchyloblepharon.—This is the partial or complete union of the edges of the lids; and may be relieved by simple division of the adhesions with the knife or scissors and the subsequent forcible separation of the lids several times daily until the wounds have cicatrized.

Diseases.—TRACHOMA, OR GRANULAR CONJUNCTIVITIS. This disease is often associated with a low state of health, or bad hygienic conditions, exposure to bad weather or irritating substances, and is unquestionably sometimes, if not always, the result of infection. It is essentially chronic in character, although acute outbreaks may occur. The diagnosis is usually easy, and is made from the appearance of more or less numerous and conspicuous granular bodies upon the conjunctiva of the lids, in connection with a mucous or muco-purulent discharge from the eyes, photo-

phobia and inflammatory thickening of the lids. From mechanical contact with the granulations, and the constant rubbing to which it is exposed by movements of the eye, as well as from the atrophic degeneration of the epithelium of the lids and globe, the cornea is liable to become vascular and opaque, or even to slough. The course of the disease may be extremely tedious, and may end in partial or total loss of vision. The treatment by means of caustics, and astringents, such as crystals of copper sulphate, alum, nitrate of silver or glycerine tannate, is often effectual, but fails to cure many cases, which are generally long-lasting. The same may be said of treatment by means of internal medication. Remedies given internally are valuable adjuvants and recourse may be had to sulphur, mercurius, rhus, pulsatilla, aurum, nux, etc.; but if reliance is placed solely upon their aid the results are likely to be disappointing. The results of operative treatment, on the other hand, are often brilliant and far superior to medicinal measures, when properly indicated. The indication to be met in operating for trachoma is to evacuate the trachoma follicles and thus hasten the restoration of the normal epithelium. This is best done by squeezing out their contents.

The roller forceps devised by Knapp (Fig. 1019) are excellent for this purpose. They are used as follows: The patient is usually anesthetized, although the injection of a few drops of a one per cent. solution of cocaine under the conjunctiva of the lid, especially along the retro-tarsal fold, may make the pain quite bearable. The lid is everted, and one blade of the forceps is passed on either side of it clear to the fornix. The blades are then closed and held firmly, and the instrument drawn outward so that the rollers traverse the lid from the cul de sac to the lid border, compressing and squeezing out the contents of the follicles as they roll along. The maneuver may be repeated until all of the follicles have been evacuated. Irrigation with sublimate 1:2000 may be practiced, although some operators do not consider it necessary. Relapses are treated by repeating the operation, or by touching the granules with sulphate of copper crystal.

PURULENT CONJUNCTIVITIS; GONORRHEAL CONJUNCTIVITIS; OPTHALMIA NEONATORUM: These are specific contagious inflammations of the conjunctiva, attended with swelling and edema of the lids and conjunctiva and profuse purulent discharge from the eyes. The microscope reveals the presence of a characteristic bacterium in the discharge. The disease may lead to abscess and sloughing of the cornea.

Treatment. Corneal complication will be discussed in treating of corneal diseases. As nearly perfect cleanliness of the eyes as possible, usually requiring the constant attention of a special nurse day and night, the constant use of iced compresses (at least until the cornea becomes involved, when heat may be substituted), irrigation with some antiseptic such as sublimate 1:5000 or peroxide of hydrogen 1:2 or stronger, brushing the conjunctiva of the lids daily with a five or ten grain solution of the nitrate of silver, together with the internal administration of argentic nitricum, mercurius, hepar, pulsatilla, rhus, apis, euphrasia, or other remedies as indicated, are the usual therapeutic

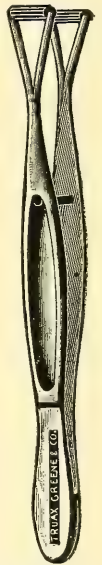


Fig. 1019.
Roller For-
ceps.



Fig. 1.

IRITIS. Pupil irregularly dilated under atropine, showing adhesion of pupillary border to capsule of lens.



Fig. 2.

Traumatic cataract with rupture of lens and portion of lens substance.



Fig. 3.

Coredialysis. Rupture of peripheral attachment.

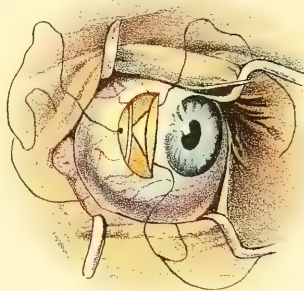


Fig. 4.

Insertion of sutures in operation for advancement of rectus internus muscle.



Fig. 5.

Pterygium.

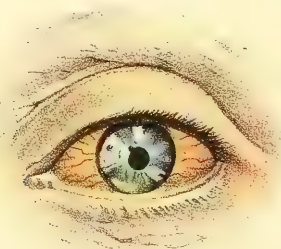


Fig. 6.

Hypopyon keratitis.

measures resorted to. Good results are often obtained without the local use of the nitrate of silver, and some surgeons do not resort to it. Where the swelling and edema are very great and cause undue pressure of the lids upon the globe a canthotomy may be necessary. Scarification of the conjunctiva by means of radiating incisions may be done to relieve the swelling of the conjunctiva of the globe, but is a proceeding of doubtful utility.

PTERYGIUM. (Plate LII, Fig. 5). Consists in an hypertrophic condition of the conjunctival and sub-conjunctival tissue of the globe, usually resulting from exposure to atmospheric agencies. It may be recognized as a thin, triangular, vascular growth with its base at one of the canthi (usually the inner), and its apex at the corneal margin. It tends to encroach upon the cornea and may thus lead to blindness.

Treatment. The internal administration of zinc, as well as its local employment as zinc sulphate (1-2 gr. to the oz.) have seemed to result in cure in numerous instances. If the growth is small, medicinal measures may properly be tried, but where the cornea is much implicated surgical measures will ordinarily be relied upon. The common operation for its removal is excision. The conjunctiva along the upper and lower border of the growth is divided with scissors; the base is severed close to the

canthus; the sub-conjunctival tissue is dissected up so as to free it from its attachments to the globe, and seizing it with a pair of strong forceps it is torn from the cornea, and the



Fig. 1020. Von Graefe Cataract Knife.

conjunctival wound closed with sutures. If the corneal attachment is too intimate to be separated by tearing a Von Graefe cataract knife (Fig. 1020) may be passed under the scleral portion and the growth shaved off as close as possible to the surface of the cornea. If the pterygium reappears the operation may be repeated.

CHAPTER VII.

INJURIES AND DISEASES OF THE CORNEA.

Injuries of the Cornea and their treatment have already been referred to.

Diseases.—**CIRCUMSCRIBED PURULENT INFLAMMATION.** This sometimes occurs in connection with other corneal affections, such as phlyctenular keratitis, but may be the result of infection independent of other disease. The diagnosis is to be made from the presence of one or more small infiltrated spots in the superficial layers of the cornea, often with yellowish centers and hazy edges.

Treatment. The infiltration may be absorbed under irrigation with sublimate solution 1:5000 and the use of such remedies as mercurius or hepar sulphur, internally. A more radical measure consists in removing the infiltrated portions with a sharp curette, in addition to the treatment indicated.

HYPOPION KERATITIS. (Plate LII, Fig. 6). Believed to be always due to infection from pyogenic germs. The cornea is more or less infiltrated and hazy, and an ulcer is formed which extends rapidly. Very severe pain may be present. Pus may accumulate in the lower part of the anterior chamber, sometimes so abundantly as to extend as high as the pupil. The ulcer may perforate, and the anterior chamber be evacuated with prolapse of the iris. The course of the disease is rapid and destructive.

Treatment. Local measures will consist of the use of antiseptic irrigation with sublimate 1:5000 or 1:2000, hydrogen peroxide 1:2, or chlorinated soda 1:5. The cauterization of the ulcer with the galvano- or thermo-cautery is of very great value in checking its extension. If a cautery apparatus is not accessible a probe heated red-hot will answer, or the ulcer may be touched cautiously with a probe which has been dipped in pure carbolic acid. In using the cautery a small round or cone-shaped tip should be selected, and the surface of the ulcer touched lightly over its entire extent. A dull red heat will be most easily managed. The eye should be cocainized, and the parts to be cauterized freed from excess of moisture. The ulcer may be so deep and have so thin a bottom that the cautery point may cause a perforation of the cornea. Prolapse of the iris into the perforation should be avoided by the use of atropine or eserine as indicated. Otherwise there is no particular danger from the accident.

In place of using the cautery the ulcer may be scraped out with a sharp corneal curette. These methods have for their common object the destruction of the infective micro-organisms of the ulcer, and the beneficial results following their employment are a practical demonstration of the usefulness of the theory upon which they are based. Much valuable service is, however, to be derived from remedial agents. These will be referred to in discussing ulcers of the cornea. The ulcerative process is sometimes so extensive as to destroy almost the entire cornea. When

the ulcer is large and its progress very rapid much benefit may be derived from Saemisch's operation. This consists in splitting the ulcer with a Von Graefe knife. With its cutting edge up and its blade perpendicular to the corneal surface the knife is entered at the edge of the ulcer upon its temporal side, until its point penetrates the cornea. It is then carried beneath the ulcer through the anterior chamber and brought out at its opposite edge, cutting its way upward and out, and dividing it completely along its entire extent. The aqueous, together with perhaps some of the purulent accumulation in the anterior chamber, is evacuated. For a few days the wound may be opened daily by passing a small probe between its lips. If the pus in the anterior chamber becomes considerable in amount it may require evacuation by means of a paracentesis of the cornea.

PARACENTESIS OF THE CORNEA. The lids are separated with a speculum, and the eyeball grasped with fixation forceps at a point opposite the place of the intended incision. A small triangular keratome (Fig. 1021) is entered at the point selected, its point first penetrating the cornea perpendicularly to its surface, but the incision itself being made in a plane parallel to the iris, its depth being regulated by the size of the incision desired. In withdrawing the knife its handle is depressed, raising the point toward the under surface of the cornea, and its removal is effected slowly, permitting the gradual escape of the aqueous and preventing the accidental wounding of the lens. The hypopion may consist of such thick or fibrinous matter as not to be spontaneously evacuated. In this case the anterior chamber may be washed out with an appropriate syringe filled with sterilized salt solution (0.75 per cent.). A Von Graefe knife may be used in place of a keratome in making the incision, as will be described under the operation of iridectomy. The ordinary small paracentesis needle is usually too dull to be of service.



Fig. 1021. Jäger's Keratome.

ULCERS OF THE CORNEA. These may occur in the course of inflammatory affections other than the foregoing, such as purulent conjunctivitis or trachoma, or they may arise independently. Examining the cornea by means of a window reflex, the situation, depth and size of the ulcer may be easily made out.

Treatment. The general health of the patient is of great importance. Good food, pure air and hygienic surroundings are important factors in the accomplishment of a cure. Remedial measures consist in the use of such remedies as hepar, mercurius, conium, arsenicum, calcarea carbonica, sulphur, silicia, rhus, kali bichromicum, pulsatilla, graphites, euphrasia. The local treatment already detailed for the ulceration of hypopion keratitis may be usually employed with great advantage, especially the use of the cautery.

OPACITIES OF THE CORNEA. Where the ulceration is so deep that the destructive process extends into the parenchyma of the cornea opacity of that tissue is usually left after the ulcer is healed. This opacity may vary in different cases, from the slightest discernible haziness (nebula), to a dense opaque spot (leucoma). The disturbances in vision are consequently very considerable, particularly where the ulcer has been situated in the pupillary area. The resulting distortion of the

cornea, when the opacity is slight, may sometimes be corrected by an appropriate astigmatic lens. Where the opacity is circumscribed, but involving the center of the cornea, if there is a portion of clear cornea at one side a small iridectomy opposite this area may restore useful if not accurate vision. For cosmetic purposes it is occasionally desirable to conceal the opacity by tattooing it with India ink.

TATTOOING THE CORNEA. A dense, pasty, black ink is prepared, the eye is cocainized, and the ink is pricked into the cornea under the epithelium, by means of a sharp needle, or a special tattooing-needle. A common method is to spread the thick ink over the part to be operated upon and to prick through it. Several sittings may be required to cover a large area, or to give it the necessary density.

TRANSPLANTATION OF THE CORNEA. An operation that has been attempted many times without success. The most encouraging method yet suggested is that of Hippel. It consists in removing with a trephine (a special instrument run by clock-work has been devised) a small button of the opaque cornea, leaving Descemet's membrane intact, and in transplanting into the pit thus left a button of rabbit's cornea, of the same size, also removed with the trephine, but including all of the corneal layers.

There are so many blind persons in whom an opaque cornea is the only obstacle to vision that if it becomes possible to replace any portion of this opaque tissue with other tissue which will remain permanently transparent, a great step in surgical progress will be achieved.

Slight opacities may be much benefited by the use of a galvanic current through a specially devised electrode applied directly upon the cornea; 1 to 1.5 milliamperes are used during sittings of five minutes. Independent of any treatment, the corneal opacities of childhood will usually be diminished in density and extent as the patient grows older.

STAPHYLOMA OF THE CORNEA. This consists in the bulging, opacification and distortion of this membrane, due to extensive sloughing, usually from purulent disease. This condition may involve not only the cornea but also the sclera, and may vary greatly in extent and location. If partial and near the corneal margin some useful vision may yet remain, but when extensive or total the entire loss of vision may accompany it.

Treatment. The treatment is by means of one or more operative procedures, such as iridectomy, sclerotomy, the excision of a section of the cornea and union of the wound with sutures, or the ablation of a portion or of the entire cornea, with or without the evacuation of the lens capsule. Just what to do for any particular case depends upon the conditions therein present, and the judgment of the surgeon must determine the course to be followed. If there is danger of sympathetic inflammation of the other eye the staphylomatous globe may be eviscerated or enucleated. If an artificial eye is to be worn as good a stump must be sought for as is consistent with safety, i. e. such a one as will be least likely to set up sympathetic inflammation of the sound eye.

CONICAL CORNEA. It depends upon some peculiar change in the substance of the cornea, perhaps atrophic, by which, although its transparency is unimpaired, its curvature becomes increased and irregular under the action of the normal intra-ocular pressure. The distortion may cause

it to assume a conical shape, with its apex near the corneal center. The disease is usually progressive, and impairs vision greatly.

Treatment. Norton recommends calcaria iodata, eserine and pulsatilla as remedies useful in checking the progress of the disease. Stenopaic, hyperbolic or cylindric glasses may be given to improve vision. For a more radical treatment the galvano-cautery may be used to cauterize the apex of the cornea, at one or more sittings, until perforation takes place. The iris may prolapse along its pupillary margin, when after healing has taken place an iridectomy may be made.

CHAPTER VIII.

INJURIES AND DISEASES OF THE IRIS AND CILIARY BODY.

Injuries.—Injuries of the iris and ciliary body usually result from blows from incised wounds, or from the penetration of foreign bodies. A blow upon the eyeball may cause rupture of the iris, or the limited separation of its peripheral attachments (core-dialysis, irido-dialysis). (Plate LII, Fig. 3). Incised wounds of the cornea may allow the prolapse of the iris into the wound, with ensuing iritis, irido-cyclitis, or sympathetic ophthalmia. Foreign bodies may incise or lacerate the iris, or may effect lodgment in its substance, or may induce inflammatory lesions such as the foregoing.

TREATMENT. In order to avoid prolapse of the iris, the use of eserine is commonly indicated (0.1 per cent. to 0.2 per cent. solution, two or three times daily), unless the wound or perforation is near the corneal center, when atropia sulphate, 0.50 per cent. to 1 per cent., two or three times or more daily, may be substituted. Foreign bodies in the iris may occasionally be removed with forceps or curettes through an appropriate incision in the cornea, but if this is not possible an iridectomy, including the foreign body with the portion of the iris excised, should be performed.

Tumors.—Sarcomatous, cystic and vascular growths occur.

TREATMENT. Sarcoma will generally require the enucleation of the eyeball. The removal of the tumor itself, through an iridectomy, is too likely to be followed by extension of the disease and general systemic infection. Cysts require extirpation. Under cocaine, the cornea is opened either with a Von Graefe knife alone, or with the knife at first, and the subsequent enlargement of the wound with scissors, so as not to rupture the cyst. When the wound is sufficiently large the cyst is grasped with forceps, ruptured, and both the sac and the adherent iris are drawn out of the wound and excised.

Diseases.—**TREATMENT.** The acute inflammatory diseases of the iris and ciliary body do not, as a rule, require surgical treatment. Their results, however, often do. (Plate LII, Fig. 1). Adhesions of the iris to the lens capsule (posterior synechia) may require iridectomy for the prevention of recurrent attacks of inflammation, or for visual purposes. Iridocyclitis, with loss of vision and persistent, intractable pain, may require iridectomy, evisceration or enucleation of the globe.

IRIDECTOMY. This operation is indicated for the formation of an artificial pupil; when the natural pupil is obstructed or the cornea over it is distorted or opaque; for the relief of posterior synechia; for glaucoma; as one of the steps in the extraction of cataract, and in a variety of miscellaneous conditions.

The operation is usually done under cocaine, using a four per cent. solution, beginning the instillations fifteen minutes before the operation, repeating at intervals of five minutes. The eye is irrigated with normal

salt solution, the lids and lid borders being wiped as clean as possible. The speculum being inserted, the operator makes fixation of the globe at a point opposite the site of the proposed iridectomy. The place and extent of the incision vary with the purpose for which the operation is performed.

For visual purposes it lies in the transparent margin of the cornea (Fig.1022), its size varying with the extent of iris to be removed. For

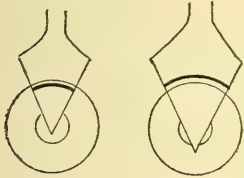


Fig. 1022. Fig. 1023.
Fig. 1022. Showing the Location and Size of the Corneal Incision in Iridectomy for Visual Purposes.
Fig. 1023. Showing the Location and Size of the Corneal Incision in Iridectomy for Glaucoma.

glaucoma the incision should be made in the sclera, $1-1\frac{1}{2}$ mm. from the corneal margin (Fig.1023), and should be 6-8 mm. in length. (See also Fig.1024). A triangular lance knife, or a Von Graefe knife may be used to make the incision. When the anterior chamber is shallow, or when all possibility of injury to the lens is to be avoided, the latter knife is to be preferred. In making an incision with the lance the size of the knife selected depends upon the proposed extent of the incision. Its point is entered perpendicularly to the surface of the cornea at the place chosen, and as soon as it appears in the anterior chamber the blade is depressed

and the incision completed in a plane parallel to the iris. If the entire incision is made in this plane the point of the knife may not emerge from the cornea at all, or if it does the inner wound will be much too small. When the knife has been pushed far enough the point should be raised toward the cornea and the blade withdrawn slowly. Particular care should be taken not to allow the point of the knife to come in contact with the lens, otherwise traumatic cataract will follow. If the Von Graefe knife is employed the incision should be made similar to that in the peripheral linear extraction of cataract. (See Cataract.) When the incision is completed the fixation forceps are given to an assistant. If the iris has prolapsed into the wound it is grasped at its middle near the pupillary border with the iris forceps and drawn out of the wound. If the iris has not prolapsed the forceps are inserted into the lips of the wound and passed into the anterior chamber until their points have reached the pupillary margin of the iris, when they are spread and the iris grasped between them and withdrawn. Gentle traction upon the iris is now made in its own plane, and it is drawn out of the wound more or less, depending upon the height to which the iridectomy is to be carried.

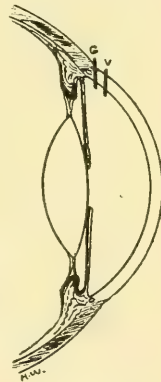


Fig. 1024.
Vertical Anterior-Posterior Section of Anterior Portion of Eyeball, Showing, V, Place of Corneal Incision in Visual Iridectomy; G, Same, in Iridectomy for Glaucoma.

In visual iridectomies it is not needful to excise the iris clear to its periphery, while in glaucoma as much of the ciliary portion of the iris is to be removed as possible. When the iris has been drawn out as far as is necessary it is cut off close to the wound with curved scissors, with one cut or two, depending upon the size of the iridectomy. This step of the operation may be somewhat painful and the patient should be cautioned to avoid any sudden movement of the eye, lest the iris should be torn from its attachments. The speculum and fixation forceps are

now removed, and the eye closed for a few moments. Finally the wound is carefully examined and freed from any portions of the iris which may be caught between its lips. It is imperative that the edges of the iris should be free from any entanglement in the wound. A small spatula may be used to replace them if they appear in the angles of the wound. Hemorrhage from the incision of the iris is frequent, and blood may appear in the anterior chamber. No particular effort is necessary to remove it, as it will be absorbed. Clots in the corneal wound should be removed, the eye irrigated with salt solution, and a light dressing applied. The court-plaster strip already described is an excellent method of closing the eye. The sound eye need not be bandaged but should be kept closed, and the patient cautioned to remain quiet. The operated eye may be uncovered on the third or fourth day.

When extensive adhesions have taken place between the iris and lens capsule a simple iridectomy is not only difficult but of little value for visual purposes, since a clear pupil cannot be obtained. In such cases the lens should be extracted.

IRIDOTOMY. This operation is usually resorted to when the iris has been prolapsed and is drawn over the pupillary area, or when closure of the pupil occurs from the development of a pupillary membrane, or when the iris is adherent to the capsule. These conditions are usually the result of cataract extractions. The operation for the formation of a new pupil may be performed with knife-needles passed through the cornea and slitting the iris; or a lance-knife is used to make a corneal incision near the limbus, 4-5 mm. in length. (Figs. 1025, 1026). After the aqueous has been evacuated, and before the knife is completely withdrawn, its point is pushed through the iris or membrane, making a small opening in it.



Fig. 1025. Plain Iris Needle.

De Wecker's iridectomy scissors are then introduced with their blades closed, one blade is passed through the opening, behind the iris, the other in front, and the desired cut is made. If the iris does not retract, leaving a clear pupil, a V-shaped cut may be made. Some vitreous may be lost, but this is not a serious accident. The after-treatment is the same as for iridectomy.



Fig. 1026. Iris Knife.

CHAPTER IX.

CATARACT.

Definition.—Opacity of the lens or its capsule is called cataract. The causes of cataract are the senile involution of the lens, diabetes, renal disease, ergotism, exposure to intense heat (as in workmen in glass factories), traumatism, severe intra-ocular inflammation, or heredity.

Treatment.—The natural progress of cataract, especially of the senile variety, is by no means uniform. Many cases, uninfluenced by treatment of any sort, have grown better, or have remained stationary, while others have progressed steadily toward maturity. Naturally this fact renders the inferences which have been drawn from cases in which remedies have been administered somewhat uncertain, and we cannot unhesitatingly adopt the conclusions which some enthusiasts have reached concerning the curability of cataract with medicines. From such statistics as are available the following conclusions seem to be reasonably warranted:

First. The vision of patients having incipient cataract has sometimes improved so much under the administration of remedies prescribed upon the totality of the symptoms, as well as upon special indications, that the extraction of the lens has been postponed or has become unnecessary.

Second. The relief of eye strain has sometimes been followed by a similar improvement in vision, and a retardation in the cataractous process.

Third. Since a certain length of time must usually elapse before cases of incipient cataract are ready for operative treatment, in view of the above statements it is permissible, if not obligatory, during this waiting period to attempt, either by the administration of remedies or the relief of eye strain, to afford the patient all possible chances of improvement in his condition.

Fourth. When a surgical operation for cataract is properly indicated it should take precedence over the administration of drugs or other remedial measures.

If we are to prescribe for a case of incipient cataract the constitutional symptoms of the patient are the only guide in the selection of the remedy. There are no specifics. Cures have been reported from the following remedies: Silicia, conium, pulsatilla, phosphorus, cannabis sativa, sulphur, calcarea carbonica, lycopodium, graphites, euphrasia, spigelia, belladonna, stramonium, mercurius, magnesia carbonica, baryta carbonica, causticum, sepia, nitric acid, kali iodatum, iodoform, cineraria maritima and many other substances employed empirically.

Operative Considerations.—From a surgical standpoint the most important considerations with respect to the lens itself, in a case of cataract, are as to its size and consistency. These are important from the fact that they afford the means of determining the choice of an operation for its removal. There is no method of extraction which applies equally well to all cases of cataract, although some methods are of much

wider application than others; and to select that operation best suited to the particular case under consideration implies some definite knowledge as to the physical characteristics of the lens to be removed. This knowledge may be obtained with considerable accuracy from the history of the case and from an objective examination of the lens itself.

In the first place, the size and consistency of a cataractous lens depend upon those changes which take place normally in all lenses. In infancy and childhood the substance of the lens is very soft and delicate and contains a large percentage of water. As the lens grows its inner filaments suffer a progressive condensation from the development of new filaments at its periphery; the proportion of water becomes less, and at about thirty or thirty-five years there is a distinct differentiation into a more or less compact nucleus and a softer cortical portion. In time the nucleus becomes harder, more friable, yellowish in color, and more distinctly differentiated. Lenses in which those pathological processes characterizing the development of cataract are taking place participate in the normal changes incident to growth, so that we do not commonly find in patients under thirty or thirty-five years of age cataracts having a sclerosed or distinct nucleus. Cataracts occurring before this age, therefore, are usually of soft consistency and homogeneous throughout. Sclerosis of the nucleus may occur in childhood, it is true, but is very exceptional. Cataracts occurring after this age will be found to possess nuclei of greater or less size and hardness. In general terms, therefore, referring to the consistency of the nucleus, it may be said that juvenile cataracts are soft, senile cataracts hard; the cortical portions of the lens remaining more or less soft, perhaps, in both cases.

A cataract may be considered ripe when it offers the most favorable prospects for a surgical operation. Usually this corresponds with the period at which the primary changes in the lens have reached their fullest development. The length of time during which a cataract has existed may not be of much significance in determining the degree of its maturity. Soft cataracts usually develop more rapidly than hard; cortical or mixed more rapidly than nuclear; indeed, in some nuclear cataracts the outer layers of the cortex never lose their transparency, so that from an anatomical standpoint they might be said never to become mature. Senile cortical cataract may develop rapidly for a time and then remain stationary for years. The actual maturity of a cataract must be ascertained by its inspection, either with the ophthalmoscope or by the aid of direct or oblique illumination with a good light. Immaturity of the cataract may be determined by the presence or absence of a shadow on the iris upon the lens under oblique illumination. If some of the anterior and outer layers of the lens are still transparent the iris will cast a shadow, the depth of which depends upon the depth of the transparent layers. In some cases of nuclear cataract there may be a general sclerosis of the lens while its superficial layers retain their transparency; such cases may, however, be considered mature, since, owing to the sclerosis, the lens separates completely from its capsule during the performance of an operation for its extraction. If the superficial layers of the lens are still normal they will adhere to the capsule, and not only render the operation difficult but from their retention in the eye are likely to result in serious inflammation following the operation. The fragments

which are retained are, moreover, likely to proliferate and give rise to secondary cataract and adhesions of the iris. In considering the question of ripeness the consistency of the superficial layers of the lens is of the highest importance. If these are soft, fluid or pulpy it is not of so much consequence what may be the consistency of the nucleus, as under these circumstances even a large and tolerably consistent nucleus may be removed with ease and safety. From the age of fifty-eight to sixty the cortex will separate readily from the capsule, whether it is transparent or opaque. A cataract occurring in a patient of this age or older may therefore be considered ripe for operation whenever the loss of vision is such as to demand some help. It is not necessary to wait for complete opacification of the lens. Up to a certain point the progressive ripening of a cataract is increasingly favorable to its proper removal, but where it becomes over-ripe and the lens-matter has degenerated into a soft or fluid substance containing hard, chalky granules or fragments, or where the superficial layers have become hard and adherent to the capsule, extraction becomes troublesome and dangerous, owing to the difficulty of removing these hard substances from the eye.

INDICATIONS FOR OPERATION. The mere existence of cataract does not determine the desirability of an operation. In general, it may be said that an operation is not indicated unless there is a reasonable prospect of materially improving the vision of the eye to be operated upon. In rare instances it may be allowable to operate upon an eye where no improvement in vision is possible for the purely cosmetic benefit of restoring the pupil to its normal blackness. It goes without saying that in order to secure perfect vision from an operation the percipient elements of a cataractous eye must be normal. It is of the highest importance, therefore, that an eye upon which an operation is proposed be examined not only with reference to the nature of the cataract itself but also with respect to its power of light perception. An otherwise healthy eye in which a mature cataract exists ought to be able to detect the light coming from a candle at eighteen or twenty feet, in a darkened room; to indicate the direction of its movements when carried about, to one side or up and down, and to indicate its position accurately with the finger. If the light is shaded and carried to different portions of the field of vision and then exposed the patient ought to indicate its position without error.

An operation for cataract may be contra-indicated not only where the examination shows such failure of light-perception that there is no prospect of restoring any useful vision but also where any conditions exist which may jeopardize either the performance of the operation or the progress of healing. The existence of chronic or acute inflammation of the conjunctiva contra-indicates an operation, from the extreme probability that the corneal wound will become infected and so lead to destructive inflammation of the eye. In such cases the conjunctivitis must be controlled, if possible, by appropriate treatment, even if this takes many months. If after a sufficiently long and careful effort the conjunctivitis cannot be relieved and an operation is well indicated in other respects this may be performed after a proper explanation to the patient as to the possible chances of failure.

The existence of dacryo-cystitis is a serious obstacle to an operation, from the highly infectious nature of the secretions from the lachrymal passages. If a cataract operation is to be performed in the presence of

this disease it is absolutely necessary that these discharges be prevented from coming in contact with the wound until it has become healed over ; that is, for at least twelve hours, and longer if possible. This may be done by resorting to Bowman's operation, cleansing the sac and duct, as far as possible, and inserting a large and firm plug of iodoform-cotton into the inner opening of the slit canaliculus, completely closing it against the exit of discharges from the sac. (Pagenstecher.) This plug may be removed upon the day following the operation, under antiseptic precautions, and a new one inserted. If the discharges from the sac are purulent it may be better to probe the stricture and inject the sac with antiseptic solutions until they have lost their purulent character.

The condition of the patient may forbid an operation. If there is an acute cough it is better to wait until it has been relieved, since paroxysms of coughing are very likely to produce prolapse of the iris, loss of vitreous, or faulty coaptation of the lips of the wound. Diarrhea and hay-fever likewise contra-indicate operating. Common sense will usually be a sufficient guide as to whether the patient's general condition forbids the operation.

POSITION OF PATIENT—PREPARATION. The only special preparation of a patient about to undergo an operation for cataract is the preparation of the operative field, consisting of the eyeball, lids, brows, and the face in the immediate vicinity of the eye. The external parts are all to be carefully cleansed, preferably by the use of warm water and soap, using either a soft sponge, cotton or soft cloth for the purpose. It is particularly important to see that the edges of the lids along the roots of the lashes are thoroughly washed and wiped, until they are as nearly absolutely clean as possible. After the use of soap and water or alkalies, removing somewhat the oily matters from the surface of the skin, a solution of sublimate, 1-2000, may be used, although the very brief time for which it can remain in contact with the skin necessarily precludes any special antiseptic action. The eyeball may be irrigated with sublimate solution, 1-5000, or other antiseptic, or, preferably, with normal salt solution. The room and bed must also be clean. Open wounds, ulcers, etc., must be covered with an antiseptic dressing.

The operation is usually performed with the patient reclining upon a bed or suitable table. In general, it may be said that that position should be chosen which is most easy and comfortable for both patient and operator. Some patients cannot lie upon a table with comfort, others find it easy. If the surgeon is ambidextrous he may sit at the patient's head and operate in this position upon either eye, otherwise in operating upon the left eye he will sit upon the right side facing the patient, at least while making the corneal incision. The sterilization of instruments has already been discussed. Scrupulous cleanliness must be observed in every particular. As a rule cocaine is the only anesthetic employed. Children and very nervous or unruly patients may require the administration of chloroform. A four per cent. solution of cocaine is ordinarily used and should be made fresh with sterilized water shortly before each operation. One or two drops are instilled into each eye four times, at intervals of five minutes, during the fifteen minutes immediately preceding the operation, as already described, or if a deeper anesthetic effect is desired the time may be extended five or ten minutes and the number of instillations increased.

CHAPTER X.

OPERATIONS FOR CATARACT.

Operative Classification.—The operations for cataract divide themselves naturally into three classes: First, those in which the lens is moved bodily within the eye to some point not in the visual axis, and is left there. Second, those in which the capsule of the lens is cut or torn, so that the substance of the lens is brought into contact with the aqueous and is absorbed. Third, those in which the lens, either with or without its capsule, is removed from the eye through an opening into the globe.

Operations under the first class are called operations by displacement or couching. They have purely an historical interest.

The needle operation is available in cases of lenticular cataract occurring in patients under the age of twenty years. (See Plate LII, Fig. 2.)

The operation is performed under cocaine, or under chloroform in patients too young to remain quiet, the pupil being fully dilated with atropine. In patients over twenty years of age a preliminary iridectomy may be made with advantage, particularly in those cases in which the pupil does not dilate readily. The lids being properly separated, the eyeball is steadied by means of the operator's fingers, and a sharp needle is passed into the anterior chamber through some point in the cornea, two to four millimeters from the sclero-corneal border. As a matter of convenience the nasal or temporal side is usually selected. The capsule of the lens is now incised with the point of the needle and the substance of the lens slightly broken up, one clean cut extending across the face of the lens being usually sufficient, at least at the first operation. Care must be observed not to disturb the lens matter too deeply, or too great a swelling of the lens may ensue; and the operation must be performed so gently that the lens is not dislocated. The operation being completed and the needle withdrawn atropine is instilled and the eye dressed with ice or cold water compresses, to control the severity of the reaction which may ensue. Ordinarily there is not much reaction, but cases occasionally occur, particularly in older patients, where after the operation the lens matter swells rapidly, pushing itself forward through the pupillary space until it nearly fills the anterior chamber; the aqueous becomes hazy; the iris discolored; circumcorneal redness and perhaps chemosis occur, and the patient suffers more or less severe pain. Under such circumstances the use of atropine may be resorted to, instilling a four per cent. solution as often as every hour in cases of only moderate severity, while in the more severe cases a free paracentesis of the anterior chamber with a lance knife should be made without delay. When this is done not only should the aqueous be evacuated but as much of the soft lens matter should be expressed through the wound as possible.

Very commonly a second or third operation is necessary before the lens is completely absorbed, and it may require a year in order to

complete the absorption. It is not considered advisable to repeat the dissection under three months from the time of the last operation, although no absolute rule can be established. The exact length of time allowed to elapse between the operations depends upon the progress of the case in question. Before making a second operation it is imperative that the eye be free from irritation and redness. In case absorption is very slow, or does not occur, a linear incision may be made in the temporal side of the cornea, and the softened lens matter extracted by expression, or by means of a spoon. If a rather small amount of lens matter remain in the pupil, and there is difficulty in transfixing or comminuting it with one needle, two may be employed, entering them from opposite sides of the cornea.

Simple Linear Extraction.—This operation is indicated in soft cataracts of various kinds, pulpy, pasty and fluid; it is also useful in removing shrunken and siliculate lenses, where the nucleus is either absent or very small, and in secondary cataracts where the capsule is to be removed entire. The soft cataracts to which the operation is applicable must be soft throughout their entire substance, and not those having merely a softened cortex.

The operation may be performed under cocaine, the pupil having been previously well dilated with atropine. A straight lance knife (Fig. 1027) is entered at a point on the horizontal diameter of the cornea on



Fig. 1027. Schweigger's Linear Knife.



Fig. 1028. Sickel's Cataract Knife.

its temporal side, about two millimeters from the sclero-corneal border, and is passed into the anterior chamber in a plane parallel or a little oblique to the surface of the iris until the outer wound is about 5 mm. in length; the inner will then measure about a millimeter less. By passing the knife thus in an oblique direction through the cornea there is less danger of having prolapse of the iris, and upon withdrawal of the knife the wound closes more readily and completely. After completing the section the knife should be withdrawn slowly to avoid any sudden loss of aqueous; the cystotome is introduced and the capsule of the lens ruptured by a V-shaped incision. If the cataract is fluid or very soft most of it will be evacuated during the cystotomy. Otherwise, the Daviel spoon may be pressed against the posterior (upper) lip of the wound until it gapes, and pressure made with another spoon from the nasal side across the cornea in a backward and outward direction, expressing as much of the pulpy lens matter through the wound as possible. If the pupil still contains fragments of the lens the eye may be closed for a few minutes, until the aqueous has re-formed and the pupil is somewhat dilated, when a gentle rubbing in a circular direction over the cornea with the finger, through the closed lid, will often gather these fragments together so that they may then be easily delivered through the wound by the maneuver already described. If this is not sufficient to clear the pupil the spoon may be passed into the anterior chamber and the remaining fragments scooped out. It is not necessary to remove every particle of the lens, as small portions of it will be absorbed if left in the capsule.

Accidents.—Prolapse of the iris may occur; if it cannot be reduced the prolapse must be excised. If the vitreous prolapses before the lens has been evacuated, the operation must usually be discontinued. When the aqueous escapes the pupil may contract so much as to render further progress with the operation impossible, in which case the eye is closed, dressed and the operation postponed.

Operation for Extraction.—For the extraction of all cataracts having a sclerosed nucleus, that is, in those occurring after the thirtieth or thirty-fifth year, the simple lineal operation is inadmissible, from the small size of the wound. For the removal of such cataracts, generally called senile, numerous operations have been devised: the old flap operation, the modern

“simple” operation, DeWecker’s three millimeter flap-operation, the peripheral lineal of Von Graefe, Liebreich and many

others. The incisions made in these various operations are shown in Figs. 1029 to 1033. Those in which iridectomy is made are called “combined,” those in which it is not made, “simple” operations. We shall describe only one of these methods, that of De Wecker, although the present tendency among American operators is to operate without iridectomy. De Wecker’s is not so difficult of execution as the “simple” operation, is freer from unpleasant complications, and gives a very high average of good results. Moreover, there are signs which lead us to believe that the combined operation will ultimately be adopted by many who now extract without iridectomy.

DE WEECKER’S THREE MILLIMETER FLAP OPERATION.—*The Incision.* The speculum is inserted, and fixation of the eyeball made just below the lower corneal border, after the usual aseptic precautions have been taken. The puncture and counter-puncture lie in the corneal margin, in a horizontal line, exactly three millimeters below the tangent to the upper extremity of the vertical diameter of the cornea. If the Von Graefe knife, with which the incision is made, is 2 mm. broad,

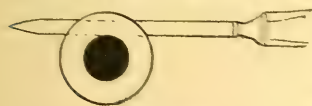


Fig. 1034.

Incision in De Wecker’s Flap Operation. The blade of the knife is 2 mm. wide, its upper edge is just 1 mm. below the summit of the cornea, the height of the corneal flap is, therefore, exactly 3 mm.

it may be laid across the cornea with its edge just 1 mm. below the summit of the corneal border, when its back will indicate the line marking the puncture and counter-puncture, as shown in Fig. 1034. The cornea is commonly 12 mm. in diameter, so that the incision embraces half of the upper semi-diameter. The knife is entered in a horizontal line, carried across the anterior chamber perpendicular to the vertical diameter, and when the counter-puncture is made is pushed forward and upward, cutting its way out by one or two sawing movements, care being taken that the section is finished gently. The incision lies exactly in the corneal border throughout



Fig. 1029.



Fig. 1030.



Fig. 1031.



Fig. 1032.



Fig. 1033.

Fig. 1029.—Corneal Incision in Old Flap Operation.

Fig. 1030.—Corneal Incision in Modern “Simple” Operation.

Fig. 1031.—Corneal Incision in De Wecker’s Flap Operation.

Fig. 1032.—Corneal Incision in Von Graefe’s Operation.

Fig. 1033.—Corneal Incision in Liebreich’s Operation.

its entire extent, or is slightly inclined forward so that its apex lies just within the transparent tissue.

IRIDECTOMY. The assistant now takes the fixation forceps and holds the eyeball in strong downward rotation. If the iris has prolapsed into the wound it is seized by the iris forceps at its middle near the pupillary border, drawn slightly out and cut off by two strokes of the scissors made in the direction of its radiating fibres. If the iris has not prolapsed the forceps are gently inserted through the wound with their blades closed, and a little fold of the iris is seized at its pupillary margin, drawn slightly out of the wound and excised with one stroke of the scissors. The amount of iris to be excised depends upon the size and character of the lens to be extracted.

As soon as the iris is cut some hemorrhage occurs and the blood may fill the anterior chamber, completely obscuring the view of the pupil. Usually it may be evacuated by waiting a few moments until the anterior chamber has refilled with aqueous; then depressing the posterior (upper) lip of the wound with the spatula, the sponge is rubbed gently across the cornea toward the wound until the pupil is sufficiently freed from blood to render the subsequent steps of the operation clearly visible. The form of the pupil secured is shown in Fig. 1034.

CAPSULOTOMY. If the speculum has been removed the lids may now be separated by means of the fingers. Fixation forceps may be used to steady the eye-ball, although most patients will direct the gaze downward if told to do so, and will hold the eye in position without them. The cystotome is introduced into the anterior chamber, passed to the lower edge of the pupil and the capsule incised by means of one or more vertical cuts—a horizontal incision across its upper portion or a V-shaped cut. Very slight pressure on the lens is made to avoid its dislocation.

DELIVERY OF THE LENS. This may be effected after the removal of the speculum, or, as many operators prefer, while it is still in place. The fixation forceps are removed, the patient is directed to look strongly downward, the Daviel spoon is placed upon the cornea, either with its convex surface or with its concavity looking upward, and pressure is made upon the eyeball directly toward its center, that is, directly backward. If the section is ample and the capsule is properly lacerated the upper edge of the lens soon appears in the wound, and may be gently pushed upward until it has been entirely delivered. It may sometimes be necessary to depress the posterior lip of the wound slightly. The patient should be cautioned to maintain absolute quiet and to avoid any movement of the eyes, and, the lens once started in motion, the gentle pressure of the spoon should be maintained as uniformly and steadily as possible until it has been expelled.

If the lens does not present in the wound when the ordinarily requisite pressure has been applied it is probable that the capsule has not been sufficiently lacerated. In that case the cystotome should be re-introduced and capsulotomy repeated. Or, if instead of the gray colored body of the lens there should appear a dark, transparent substance in the wound, it will be recognized as the vitreous body, and all pressure upon the eyeball be immediately discontinued. In the face of this accident further attempts to deliver the lens in the usual fashion will result in nothing but a greater loss of vitreous, and the only practical way of completing the

operation is to pass a spoon, or, perhaps better, a wire loop behind the lens and lift it through the wound, making little or no effort to remove any cortical matter that may be left behind. In case the lens presents in the wound promptly enough, but owing to its size cannot pass through it, it is better not to attempt undue pressure in the effort to expel it, but rather to enlarge the angles of the wound with scissors so that it may pass freely; otherwise the stretching and bruising of the lips of the wound are very apt to excite subsequent inflammation, which may result in the destruction of the cornea by suppuration.

The Toilet of the Operation.—After the expulsion of the lens it is desirable to free the pupil, as far as possible, from all fragments of the cortex which may have been left behind. This may be done, having the patient fix his gaze downward, by raising the upper lid with the fingers of one hand and then, either with the fingers of the other hand applied through the lower lid, or with the Daviel spoon applied directly to the cornea, stroking it gently toward the wound. The pupil should be cleared of all remnants as completely as may be done without using too violent or too prolonged manipulation. If some fragments are left behind they do not commonly occasion any trouble and will be absorbed in a few weeks. The introduction of spoons or traction instruments into the anterior chamber to effect their removal is not considered the best practice.

When the cortex has been sufficiently removed the pupil will appear clear and black. If any particles remain between the lips of the wound they may be removed with the iris forceps or the spoon. Blood-clots should be carefully picked up with the forceps, and the area of the wound made scrupulously clean. The spatula, after being sterilized, may be inserted into the angles of the wound, and any portions of the iris or capsule that may have become entangled there pushed back into the anterior chamber.

The patient's eyes are then closed for a few moments until the anterior chamber has had an opportunity to become re-established. He may then be directed to open his eyes quietly and a slight test of the vision made. If the operation has been successful the little glimpse into the world which he gets in this way is usually extremely gratifying and enables him to endure the confinement following the operation with greater fortitude. The patient now looks down, and with the upper lid somewhat elevated by the fingers the co-aptation of the wound and the proper position of the conjunctival flap are assured by the aid of the spatula. The eyes are again closed, the dressings are applied, and the operation is completed.

After-Treatment, Bandaging, Etc.—There is great diversity in the after-treatment of cataract operations among different operators. It is difficult to say just what are the best methods of practice, but there is a general agreement among operators that the rigorous confinement formerly insisted upon is not necessary and patients are usually allowed a certain amount of freedom, at least after the first few hours. Some operators (Chisholm) do not confine their cases in bed at all; others (Knapp) enjoin the greatest possible rest for the first twenty-four hours, and allow old people to sit up in bed a part of the day after the second day. Confinement in a dark room is also a practice of the past, at least

so far as this country is concerned, no more being required than that the room should be darkened to the point of comfort. The aching backs, the weary hours of darkness, the tedium of lying for days in one position are tortures to which the cataract patient of the present day does not have to look forward.

The eyes may be closed with strips of very soft silk isinglass plaster, about three-fourths of an inch wide and one and one-half inches long, extending from just under the brows, over the lids and upon the cheeks.

It seems more rational to close both eyes until the lips of the wound have had time to become sealed, although some surgeons leave the unoperated eye free. If both eyes are closed there is certainly much less movement of the lids of the operated eye, and greater quiet during the process of healing. It is perhaps better not to uncover the sound eye until the third or fourth day, when the wound will have become so firmly healed that the ordinary movements of the eye are not likely to disturb it. Moreover, as nearly absolute rest as possible for the first day is not particularly irksome, and certainly favors the proper healing of the wound; for these reasons it is desirable to insist upon it as a matter of routine.

Instead of using plaster as a splint for the operated eye a soft pad of absorbent cotton may be laid over it upon a piece of lint and held in place by a strip of adhesive or isinglass plaster extending from the forehead to the cheek. This forms an excellent dressing. It is light, absorbent, and may be easily removed when the eye is to be inspected or dressed, and need exert no undue pressure upon the eye-ball. The classical roller bandage may also be used.

Bodily restraint after a cataract operation is usually altogether unnecessary, although in the case of certain unruly patients, as for example those suffering from delirium, the hands may be gently tied to the side during sleep, or even continuously.

The dressings may be removed from the operated eye upon the fifth or sixth day and a shade substituted for them, the patient being told to keep the eyes closed most of the time. After the first twenty-four hours patients may be allowed to rise and attend to the calls of nature, but always under the immediate personal supervision of the nurse, until after the first week at least.

After an operation for cataract there is commonly, for the first few hours, a feeling of slight pain and irritation and an increased flow of tears. These soon cease and the remainder of the healing process is carried on without any special discomfort in the eye in normal cases. Should the pain in the eye persist the dressings should be removed and the eye examined to see if the lids are in proper position, or whether there may not be a lash or a clot of blood in the conjunctival sac.

If iritis occur it is more apt to develop during the first four or five days and is manifested by continued pain, tenderness of the eye-ball and abundant flow of tears. Atropine should be instilled, a four or eight grain solution, every one or two hours, unless symptoms of poisoning show themselves, and hot fomentations may be used every two or three hours for ten or fifteen minutes at a time.

In normal cases there is usually an increase of the conjunctival secretion for the first day or two, and the dressings are commonly soiled with

a few drops of mucus or muco-purulent matter, which may dry and harden upon the edges of the lids, rendering a change of the dressings and a careful cleansing of the edges of the lids with a bit of cotton and warm water very grateful to the patient. If the muco-purulent secretion becomes increasingly abundant or edema of the lids takes place the dressings should be removed and the eye examined. If there are any signs of purulent infiltration of the edges of the wound, or an accumulation of purulent or muco-purulent matter in the conjunctival sac, the eye should be irrigated with sublimate solution, 1-5000, or with normal salt solution, and particularly in cases where there is edema of the lids or chemosis of the conjunctiva the continuous application of cold should be at once commenced.

This is best accomplished by having small pieces of old linen or cotton, or lint, about three inches square in two or three folds (that is, a piece 3x6 inches folded twice, for example) laid on a large piece of ice, from the surface of which they are transferred and laid upon the eye, to be replaced by fresh ones as soon as they have become warm. In this way the application of cold can be kept up as continuously as the patient can bear it, day and night if necessary, by a rotation of nurses and without making pressure upon the eye to disturb the healing of the wound. In this way it is possible to avert corneal suppuration and deeper inflammations, and to save eyes that would otherwise be lost. If the suppuration of the cornea actually begins the ice should be discontinued and hot fomentations substituted, as the continuous cold has a tendency to lower the vitality of the corneal tissues. In connection with the cold applications, particularly in those cases in which there is a profuse secretion of tears, which gush out whenever the lids are separated, rhus internally is a valuable remedy. Other remedies should also be given as indicated.

When the operation has been performed in the forenoon the surgeon should visit the patient upon the evening of the same day, when the dressings may be changed and the general condition of the patient noted. If the eyes have been closed with plaster strips it is ordinarily not necessary to remove them; all that needs to be done is to see that the exposed edges of the lids are wiped clean and that the patient is in as comfortable a condition as possible. It is usually better to make two daily visits for the first three days. The patient may be discharged from the eighth to the fifteenth day. The average duration of the after-treatment will be perhaps twelve days. Glasses may be prescribed at the close of treatment, but the patient should abstain from the full use of the eyes for at least a month after the operation.

Secondary Operations.—It is usually an advantage to follow the extraction of cataract with a discission of the capsule. Knapp regards it as the final step of the operation. It should not be resorted to until the eye has entirely recovered from all irritation due to the primary operation. This may be as early as the second week. The pupil should be free from inflammatory products, and the discission should be made as early as possible, before secondary changes have taken place in the capsule, such as thickening, wrinkling and pigmentation. Usually there is a very positive gain in vision from the operation. One or two needles are passed through the cornea and the capsule lacerated at its center.

PROLAPSE OF THE VITREOUS. This may occur either before or after

the expulsion of the lens, from some defect in the operation or from excessive intra-ocular tension. In cases where the vitreous is fluid it is very difficult, if not impossible, to avoid its prolapse. The loss of a small amount of vitreous does not imply that the ultimate result of the operation may not be good.

Nevertheless, it is an accident which the careful operator will avoid if possible.

Immediately upon the appearance of vitreous in the wound the speculum should be removed and the eye closed for a few moments. If it occur immediately upon the completion of the corneal section the iridectomy will have to be made with the aid of the iris hook, as the pressure of the forceps upon the lens may easily lead to an additional loss. The lens can now best be delivered in its capsule by passing a wire loop or shallow spoon behind it and lifting it out of the wound. In passing the loop or spoon behind the lens the curvature of its posterior surface must be borne in mind, and the instrument directed sufficiently well back. The great importance of always having a suitable loop or curette at hand in extracting a cataract cannot be overestimated; prolapse of the vitreous before the delivery of the lens will occasionally take place even with the most skillful operators, and when it does occur nothing else will so well enable the surgeon to complete the operation and save the eye. If the vitreous prolapses after the lens has been expelled but before the pupil has been freed from cortical matter it is often a question requiring fine judgment whether any special efforts shall be made to extract the fragments of the cortex or not. If there are one or two large pieces remaining in the pupil, which may be secured with the curette without much danger of increasing the loss of vitreous, they may be removed, but much fishing about in the eye to gather up all that remains of the lens is injudicious. The presence of such fragments in the eye may give rise to iritis, irido-cyclitis, secondary cataract, etc., but they are frequently absorbed without doing any damage whatever, and the persistent effort to remove them may expose the eye to greater dangers than their retention.

If a considerable quantity of the vitreous prolapse it may be cut off close to the edges of the wound with a pair of curved scissors, but if the quantity is small, and the prolapse hernia-like, it may be left alone, as such prolapses are frequently spontaneously retracted within the eye, leaving the wound to heal normally.

CHAPTER XI.

INJURIES AND DISEASES OF THE VITREOUS, RETINA AND CHOROID.

Injuries.—Injuries of these tissues have already been discussed in treating of the eyeball as a whole.

Tumors.—Two very important intra-ocular tumors occur: sarcoma of the choroid, and glioma (white round-celled sarcoma) of the retina. Both of these diseases are highly malignant. By extension to other parts they result in death in the great majority of cases—not far from ninety-five per cent. Retinal glioma usually occurs in children, rarely after the tenth year, and there is no recorded case occurring after the sixteenth year. Sarcoma of the choroid may occur at any age, but is usually found in older patients. The diagnosis of these tumors is not always easy. The intra-ocular deposits in suppurative choroiditis may closely resemble glioma, and may be distinguished from it only by the history of the case.

TREATMENT. Little or nothing may be gained by the use of remedies. Enucleation of the eyeball, together with the excision of as much of the optic nerve as possible (particularly in glioma), saves a small percentage of cases, when done in the early stage of the disease; but the recurrence or extension of the growth and the death of the patient are too often the unfortunate issues, even after operating.

Glaucoma. The ultimate causes of glaucoma are not yet definitely understood, and various theories have been advanced in explanation. The mechanical cause seems to be a disturbance of the normal filtration of fluids from the eye; either an over-supply or an impeded outflow. It is a disease highly destructive to vision, and showing no tendency toward spontaneous recovery. It may be classified under two forms: First, simple or non-inflammatory glaucoma; second, glaucoma with inflammation. Under these heads we have various subdivisions, such as acute, sub-acute, chronic, hemorrhagic and secondary.

SYMPTOMS. The chief objective symptom is an increase in the hardness (tension) of the eyeball. This may be recognized by palpating the eyeball through the closed lid, with one finger of each hand, as in testing for fluctuation in an abscess. Experience only will give the surgeon the proper sense of touch by which variations in the normal tension may be appreciated. Glaucoma without inflammation, glaucoma simplex, progresses slowly. It occurs most often in patients past the middle age, and in hyperopic eyes most commonly. The symptoms may be obscure. Externally the eye looks normal. The diagnosis can be made only with the ophthalmoscope, joined with a careful examination of the visual field. Tension may be increased or may be normal. The ophthalmoscope shows cupping or excavation of the optic disc, and pulsation of the retinal arteries, either spontaneous or upon slight pressure upon the globe.

The visual field is contracted—particularly upon the nasal side—central vision may be normal. The patient may have sudden attacks of obscuration of vision, and sometimes sees colored rings or halos around a gas or lamp flame. The case may progress slowly until vision is totally lost, or there may be acute outbreaks with inflammatory symptoms.

Glaucoma with inflammation may exist as an acute outbreak in a case of simple glaucoma, or may appear independently, or may be secondary to various intra-ocular diseases or conditions, such as tumors, incarceration of the periphery of the iris, intra-ocular hemorrhage, staphyloma, and hyalitis. There is usually severe agonizing pain in and about the eyeball, which becomes red and inflamed; there may be nausea and vomiting; vision is rapidly and greatly reduced; the media turbid; the iris dilated; the cornea anesthetic, and the tension of the globe increased. The diagnosis is of the highest importance. Too much stress cannot be laid upon the necessity for differentiating this from all other forms of ocular inflammation. The rapid and extensive loss of vision, the regularity in the shape of the pupil, the increase in tension, and the violent pain will usually serve, when intelligently noted, to diagnose the disease.

TREATMENT. Except in the prodromal stage, the use of internal remedies is of little value. Relief has been observed after phosphorus, gelsemium, bryonia, osmium, prunus, spigelia, cedron. The local use of eserine (0.2 per cent. solution) is of great value in aborting threatened attacks in eyes where glaucomatous tendencies exist. It is also of much importance in the acute exacerbations of simple or chronic glaucoma, and may be used to give temporary relief before operating. The most important remedy, however, is iridectomy, the curative action of which was discovered by Von Graefe. It is applicable to all forms of glaucoma except the hemorrhagic, but is of most marked service in the acute manifestations of the disease. It is not always successful and sometimes seems to occasion an acute outbreak in the other eye. Its beneficial effect seems to be due to the fact that it re-establishes the channels of filtration at the base of the iris, by opening the "iritic angle." An iridectomy for glaucoma differs from one for visual purposes in that the excision of the iris includes as much of its base as possible. The incision must therefore lie in the sclera a little anterior to the plane of the iris, so that its peripheral portion may be accessible to the forceps and scissors. It is quite necessary, moreover, that the iridectomy be a broad one, so that the incision should measure six to eight millimeters in length, and a large fold of the iris should be grasped in the forceps. An imperfect operation may bring relief in a case of acute glaucoma, but the simple or chronic forms demand the highest operative skill. In order to avoid accidental injury to the lens in making the corneal incision, it is better to use a Von Graefe knife as described in the chapter on iridectomy, where the other technical features of the operation have already been discussed.

CHAPTER XII.

THE OCULAR MUSCLES.

Surgical Disorders.—Surgical disorders of the muscles fall under two general classes:

First. Those in which there is a tendency for the visual lines of the eyes to deviate from a parallel or symmetrical position, but in which in the ordinary operations of sight no deviation occurs.

Second. Those in which there is a permanent or spasmodic deviation of the visual lines from the position of parallelism or symmetry.

The first class of disorders is called heterophoria. It was formerly denominated muscular insufficiency. The second class of disorders is called strabismus, or squint. Before proceeding to a discussion of these disorders a few points in the anatomy and physiology of the muscles may be reviewed.

The extrinsic muscles are six in number, four recti and two oblique. They arise from the bony walls of the orbit, chiefly near the optic foramen, and, passing forward, are connected with the globe, each at two points; first, as they pass through Tenon's capsule, known as the capsular insertion, and second, where the tendon spreads out upon the sclera in the vicinity of the cornea. It is due to the capsular attachments of the muscles that their power over the globe is not entirely lost after the severance of their tendons. The tendon of the rectus internus lies at a distance of about 5.5 mm. from the corneal border; the rectus superior and inferior 6.5 mm., the rectus externus about 7.5 mm. In hyperopic eyes these distances may be less, in myopic eyes greater. The nerve supply and function of each muscle are given in the following table:

NAME OF MUSCLE.	NERVE SUPPLY.	FUNCTION.
Rectus externus.	Sixth nerve.	Draws eye outward without torsion.
Rectus internus.	Third nerve.	Draws eye inward without torsion.
Rectus superior.	Third nerve.	Draws eye upward and inward, with torsion inward, i. e., it inclines the upper end of the vertical meridian of the cornea inward.
Rectus inferior.	Third nerve.	Draws the eye downward and inward, with torsion outward, i. e., inclining the upper end of the vertical meridian outward.
Obliquus inferior.	Third nerve.	Draws the eye upward and outward with torsion outward.
Obliquus superior.	Fourth nerve.	Draws the eye downward and outward with torsion inward.

It will be observed that all of the muscles except the internal and external recti produce a torsion of the globe on its antero-posterior axis, the upper muscles rotating it inward, in the direction of the nose, the lower muscles outward, so that in movements of the eye up or down, in order to keep the vertical meridian of the cornea vertical, one upper and one lower muscle must co-operate. In Fig. 1035 the central

circle represents the cornea in the primary position, i. e. when the vision is directed straight ahead. The other circles indicate diagrammatically the position which the cornea would take if acted upon by the individual muscles respectively. The tilting of the lines representing the vertical meridian of the cornea indicates the character of the torsion (rotation upon an antero-posterior axis) produced. From the diagram the functions of the individual muscles are seen at once, and the muscles necessary to produce motion in any desired direction may be easily ascertained. Thus, to move the eye inward and upward, say at an angle of forty-five degrees, will obviously require the combined action of the rectus internus, rectus superior, and (to correct the torsion inward produced by the rectus superior) the obliquus inferior. Movement in other directions may be similarly analyzed. The diagram represents the right eye, viewed from the front.

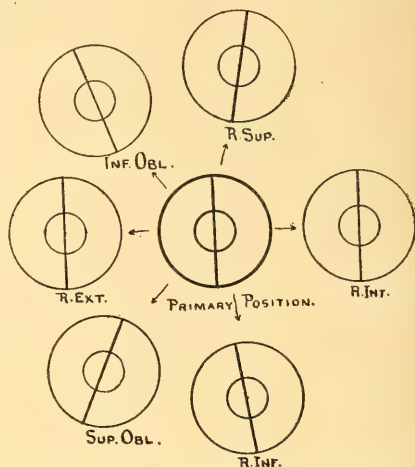


Fig. 1035. To Illustrate the Action of the Ocular Muscles in Rotation and Torsion of the Eyeball. The Larger Circle Represents the Cornea in Various Positions, the Globe Being Rotated by Individual Muscles as Indicated. The Straight Line Represents the Primary Vertical Diameter of the Cornea. Its Obliquity Indicates the Character of the Torsion Produced.

Heterophoria.—As indicated above, in heterophoria there exists a tendency for the visual lines to deviate from their normal relations to each other. The position of the eyes during the operation of vision does not differ from that of normal eyes, but the conditions under which the combined use of the two eyes is possible are quite different.

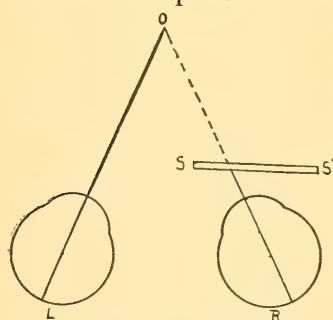


Fig. 1036. Orthophoria.

although the right eye is shut off by the screen SS, its visual line if prolonged would meet that of the right eye in O, so that if the screen were removed and binocular vision restored it would be secured by the natural and harmonious relations between the various muscles appropriate to that particular act of vision. No muscle would be doing more than its proper share of work.

If, however, when the left eye looked toward O, the right being behind the screen SS, being its usual line outward as in Fig. 1037, or inward as in Fig. 1038, when assuming its natural position, rest—least resistance—it is evident that if it has

not differ from that of normal eyes, but the conditions under which the combined use of the two eyes is possible are quite different. It is only by interrupting binocular single vision in some way that we are able to discover the existence of heterophoria. In the normal eyes the co-ordination of the various muscles which move the globe is such that when one eye is directed toward any given point the visual line of the other eye is directed toward this point also. In Fig. 1036 the left eye looks toward the point O; now,

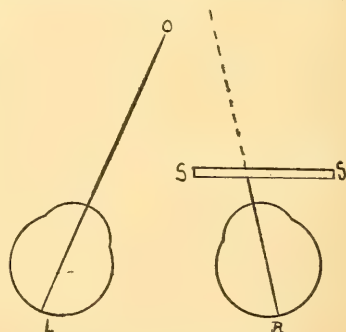


Fig. 1037. Exophoria.

it has

to keep in the direction RO, in order to give its possessor single vision with two eyes, a certain extra amount of work is required in order to retain it there. Thus, in Fig. 1037 the rectus internus and in Fig. 1038 the rectus externus of the right eye must do more work during binocular

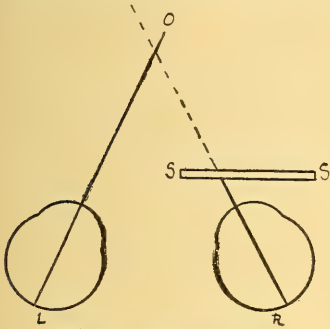


Fig. 1038. Esophoria.

vision than the corresponding muscle of the left eye, and this unequal demand upon symmetrical muscles which ought to do symmetrical work is a muscular strain, and, like any other muscle-strain may be the source of numerous reflex disorders. The various forms of heterophoria have received the following names: (Stevens) hyperphoria, (upward-tending); esophoria, (inward-tending); exophoria, (outward-tending). Hyperphoria may be further designated as right or left, meaning of the right or left eye.

The determination of the existence of these anomalies may be made in various ways. First, by the observation of the movement in one eye alternately covered and uncovered with a screen, while the patient's gaze is steadily fixed upon some small object, near or remote. This method serves roughly, and when the lack of equilibrium is considerable. Second, the interruption of single vision by means of prisms or lenses or colored glasses, and the measurement of the separation of the double images thus created. Instruments for doing this are called phorometers, of which there are many.



Fig. 1039. Orthophoria.

Among the simplest is a double prism of glass, two six-degree prisms with their bases together, held a few inches before one eye, with its axis at first horizontal and afterward vertical, while the patient observes a small flame twenty feet distant. Three images of the light are seen, two through the double prism and one with the uncovered eye. With the prism before the right eye, if there is no heterophoria, the lights will be seen in the two positions of the prism above indicated, as in Figs. 1039 and 1041. In heterophoria the lights will appear as shown in the other figures—Fig. 1042 illustrating right hyperphoria, Fig. 1044 left hyperphoria, Fig. 1040 esophoria, Fig. 1043 exophoria.

The amount of the deviation may be measured by the strength of the prism, which, placed before either eye, will cause the three lights to lie in the same straight line, so that we speak of an esophoria of three degrees, a right hyp. of two degrees, etc. For the more accurate determination of heterophoria a more elaborate instrument is desirable. Such a one is made by E. Kirstein's Sons Co., of Rochester, New York.



Fig. 1042. Right Hyperphoria.

Heterophoria has been found by experience to be productive of many forms of reflex trouble, such as asthenopia and headache, and by some surgeons has been considered as the cause of remote disturbances such as epilepsy, chorea and insanity. Whatever may be the ultimate verdict as to the

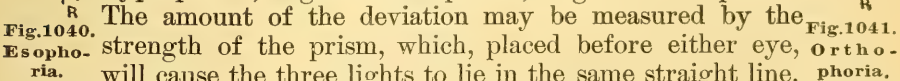


Fig. 1040. Esophoria.

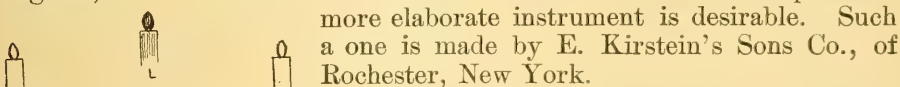


Fig. 1041. Orthophoria.

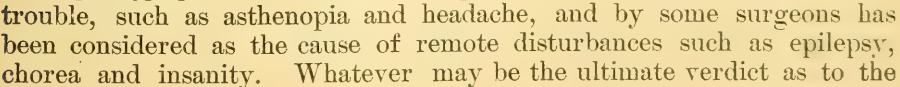


Fig. 1043. Left Hyperphoria.

exact limits of the reflex disorders it is capable of exciting there can be no reasonable doubt that it is the real cause in many cases of headache and asthenopia, at least, and that its correction is the only available source of relief for some patients. Extended discussion of the numerous problems which the study of these muscular errors affords is not required here.



Fig. 1043.
Exophoria.

TREATMENT. The correction of the various forms of heterophoria may be undertaken in one or more of the following ways: First. By the administration of the indicated remedies internally, the use of electricity, or by improvement of the patient's general condition in any way. Second. By the gymnastic use of prisms to strengthen the weak or insufficient muscle, if such exists. Third. By wearing of prisms in the form of spectacles, so placed as to correct the hyperphoria. Fourth. By surgical procedures mechanically to restore the normal muscular equilibrium.

Under the first head many remedies have been proposed and frequent cures have been reported. It is to be regretted that these reports have not always been entirely reliable or adequate. Enough has been shown, however, to warrant the belief that some cases are amenable to remedial measures. For hyperphoria the following have been recommended: onosmodium, senega, gelsemium; for esophoria, gelsemium; for exophoria, rhododendron. After a reasonable trial of remedies, electricity and hygiene, some of the other methods should be resorted to.



Fig. 1044.
Left Hyperphoria.

Second. The exercise of the ocular muscles has, in cases of exophoria particularly, often been of service. Prisms with their bases out are intermittently placed before the eyes so as to cause their convergence, and a rhythmical contraction of the interni set up, stimulating and strengthening them until there is no longer any possible doubt as to their power of doing all the work that may be required of them.

Third. Since rays of light are bent by passing through a prism, we may place before one eye a prism of such a sort that the eye may assume its position of rest, and may yet participate in binocular single

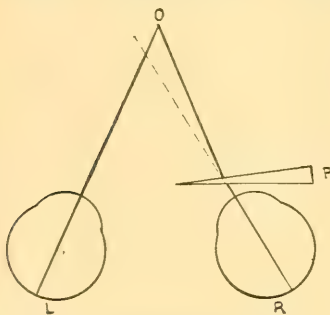


Fig. 1045.
Action of Prism Base Out, in
Esophoria.

vision. Thus in a case of esophoria of two degrees, where the right eye, it may be said, has a tendency to swing its visual line inside that of the left (Fig. 1045), a prism of two degrees base out before the right eye will permit it to swing into its position of equilibrium without disturbing single vision, as is shown in Fig. 1045. In this way many forms of heterophoria may be corrected with some benefit, particularly if the patient is already obliged to wear glasses for some refractory error. The most satisfactory method of correcting the majority of cases

will be found in a proper operation to readjust the muscles so that the position of equilibrium of the eyes is normal.

Fourth. These operations consist in an appropriate tenotomy or advancement of muscles to correct the conditions of faulty equilibrium. If, for example, in the case of esophoria above referred to there had been performed tenotomy upon one or both of the internal recti muscles so that the eyeball was converged under the natural tension of these muscles just far enough to bring the visual lines into their normal relations, as shown in Fig. 1036, obviously the heterophoria would no longer exist. Such tenotomies differ considerably from those performed for strabismus, and have been called "graduated tenotomies."

"GRADUATED TENOTOMY." The eye having been cocainized and the speculum inserted, a small fold of the conjunctiva well over the tendon of the muscle to be tenotomized is picked up with the delicate forceps specially devised for the operation, and a small opening 2 to 3 mm. in length made in it with the scissors (Stevens'); the middle of the tendon is then grasped with the forceps and an opening made into it with the scissors. The tendon, being still firmly held in the forceps, is raised slightly, and one blade of the scissors being passed beneath the tendon, the other over it but beneath the conjunctiva, the tendon is partially severed along the line of its insertion, first on one side of the wound, then on the other. When bleeding has ceased the speculum is removed and the equilibrium of the eyes tested with the phorometer. If the correction is insufficient the speculum is again inserted, the tendon seized with the forceps, and the lateral cuts across it extended further toward its edges, taking care not to incise Tenon's capsule. The eyes are again tested as before, and if the correction is still insufficient the operation is resumed, and so on until the heterophoria has been eliminated, or at least as much of it as is to be corrected by this particular operation. If the correction has been made excessive, that is, if the heterophoria has been over-corrected, a single stitch of fine black silk (No. 00000) may be inserted at the middle of the tendinous edge of the retracted muscle with a fine curved needle, and attached to a corresponding point of the tendon still attached to the globe. This may be tied with sufficient tightness to bring the muscle forward just enough to reduce the over-correction. It is probably better not to attempt the correction of more than four degrees of hyperphoria, nor more than six to eight degrees of esophoria or exophoria, at one sitting. The operation may be repeated later for any remaining defect. To increase the immediate effect both eyes may be operated on at the same time, e.g., on both interni for esophoria, or upon the superior rectus of the right eye and the inferior rectus of the left for right hyperphoria. The sub-conjunctival hemorrhage following the operation is sometimes considerable, and the eye may be left red for from one to three or four weeks, while the extravasated blood is being absorbed. No bandage is required after this operation, and the resulting discomfort is usually slight and temporary.

Strabismus.—Strabismus is heterophoria which has passed from the potential or static condition to the dynamic. The lack of balance among the muscles has been transformed from a mere tendency into an actual deviation of the eyeball. In strabismus there is no longer any pretense of binocular vision, since only one eye is at any given moment directed toward the object fixed. The causes of strabismus are to be found chiefly in some abnormality in vision, such as hypermetropia,

myopia, or astigmatism, or opacities of the cornea, most frequently when these conditions are associated with a failure of perception in one eye. Convergent strabismus is usually associated with hypermetropia, divergent strabismus with myopia, although the connection is not uniform, some hypermetropes showing a divergence of the eyes, and some myopes a convergence. Strabismus may be confined to one eye (monolateral), or the patient may squint with either eye alternately (alternating). Paralytic strabismus is due to the paralysis of one or more of the ocular muscles, and differs from ordinary strabismus not only in its etiology and pathology but in the fact that double vision exists. Vision is binocular (i. e. with both eyes), but is not single, the image in each eye being referred to a different portion of the field of vision. It is upon the position of these double-images that the diagnosis of the case is usually made. In the diagram, Fig. 1035, the various positions of the cornea illustrated will also give the position of the false image in case of paralysis of the associated muscle. Thus, in a case of paralysis of the superior oblique of the right eye the image seen by that eye will be below and to the right (homonymous images) of the normal image, when the eyes are looking straight forward, in the primary position, and will be tilted to the left. In paralysis of the right superior rectus the false image will be above and to the left of the normal image, giving crossed images, and will be tilted to the left. Looked at through the back, i. e. through the page, the diagram will represent the left eye.

TREATMENT. When errors of refraction exist they should be corrected by appropriate glasses. In some cases of slight squint, this alone will be sufficient to effect a cure. In very young children, such as those under $2\frac{1}{2}$ or 3 years of age, where the use of glasses is not desirable, atropia may be employed, a 0.1 per cent. to 0.2 per cent. solution instilled once a day, for weeks at a time. This will sometimes result in a diminution or disappearance of the strabismus. After the patient has reached his seventh or eighth year, if both glasses and atropine have failed to relieve an operation is indicated. The defect sometimes suffers a natural reduction, or disappears altogether, as the patient grows older, so that whenever an operation is performed in early childhood particular care should be taken to avoid an over-correction of the strabismus, and it is sometimes better not to correct the manifest error completely. In older subjects a more complete correction may properly be attempted. Moreover, from the intimate and constant relation of concomitance between the two eyes it is much better surgery, where practicable, to divide all muscle operations between the two eyes. It used to be a rule that where the convergence in strabismus did not exceed 5 or 6 mm. it could be corrected by a single operation upon the squinting eye. It is now considered better practice to divide the operation, even in these cases. Where advancement of the muscles is practiced it is frequently confined to one eye. The results of operative treatment are not always satisfactory. Sometimes the immediate results are good, but after a time the strabismus may become re-established. If binocular single vision can be secured, as happens in a small percentage of cases, the results are most satisfactory. If nothing else can be gained there is usually such an improvement in the patient's appearance that the operation is well justified. It is better to make a partial correction of the defect by an

operation on one eye, and to allow a week or ten days to elapse before completing the work on the other eye. If both vertical and lateral deviations exist the former should be corrected first. Convergent upward and downward squint can usually be corrected by a simple tenotomy on one or both eyes. Divergent squint usually requires the advancement of one or both internal recti, with or without tenotomy of the externi, depending upon the effect to be secured. Paralytic squint is to be treated by advancing the weak or helpless muscle, if the use of remedies such as causticum, gelsemium, rhus tox., etc., and the employment of electricity have not served to relieve the paralysis. Here we may expect from an operation only the restriction or alteration in the field of double vision, or an improvement in the patient's appearance, for the advancement of a paralyzed muscle will not give it the power of contraction. When the oblique muscles are involved the correction has to be made by operating on the recti, for anatomical reasons, e. g., in case of paralysis of the superior oblique of the right eye the resulting diplopia in a vertical direction may be corrected either by a tenotomy of the right superior rectus, or by an advancement of the right inferior rectus, the lateral diplopia being corrected by an advancement of the right rectus internus. Such corrections are necessarily very imperfect.

TENOTOMY FOR STRABISMUS—RECTUS INTERNUS. The eye is cocaine-ized thoroughly. In young children a general anesthetic may be required. The speculum is inserted and while the patient rotates the eye strongly outward a vertical fold of conjunctiva, over the lower border of the tendon, 3-4 mm. from the corneal border, is picked up with the delicate forceps used in the graduated tenotomy, and a horizontal incision 3-4 mm. long made in it with the scissors. A similar incision is then made along the upper border of the muscle, leaving a bridge of conjunctiva over the middle of the tendon. The scissors are inserted in the wound, and the conjunctiva undermined over the tendon of the muscle above and below it and inward toward and under the caruncle, the amount of such dissection being proportionate to the amount of setting-back the muscle is to receive. At the lower border of the muscle the capsule covering it is incised so as to admit the strabismus hook, the insertion of which is the next step of the operation. The hook is placed as indicated in Fig. 1046, with its tip directed down and out and, kept in close contact with the sclera, is swept behind the tendon, by carrying the handle of the instrument upward over the root of the nose and brow, its tip passing under the tendon as shown by the dotted lines of the illustration. The tip of the hook may now be brought out at the upper conjunctival wound, by a little maneuvering with the scissors, cutting through the capsule and sub-conjunctival tissue covering it. When the muscle has been well caught up on the hook the scissors are introduced between the hook and

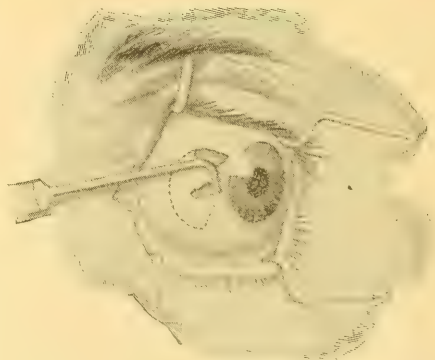


Fig. 1046. Insertion of Hook in Tenotomy of Rectus Internus.

the insertion of the muscle—one blade beneath the tendon, the other over it but beneath the conjunctival bridge—and the tendon is severed across its entire width (several snips will be necessary), so that the hook may be easily drawn toward the cornea without meeting any resistance other than the conjunctival bridge. The eyes are then examined and their position noted. The movement of the operated eye inward is tested, and if found little or not at all restricted the hook is again passed both from below and from above, to secure any fibres of the muscle which may have remained uncut. If found these are severed as before.

When the muscle has been completely divided, and its connections with the conjunctiva and subconjunctival tissue sufficiently broken up, there will be found a decided limitation of the movement of the eyeball inward (4 to 5 mm.), and a more or less complete correction of the strabismus. To increase the effect of the operation a thread may be passed into the sub-conjunctival tissue at the outer margin of the cornea, tied loosely and fastened by plaster strips to the skin at the outer edge of the orbit, or passed through the skin at the outer commissure, after making traction to draw the eye outward as much as may be desired. This suture is rather painful, and must usually be removed on the second day. The bridge of conjunctiva that is left standing in this method of operating seems to lessen the excessive sinking-in of the caruncle, so common a result of the operation as usually performed. The most common method of performing the operation is to make a vertical incision in the conjunctiva near the corneal border, and, after undermining the conjunctiva, to secure the muscle upon the hook and sever it as above, and finally to unite the conjunctival wound with a suture. This is perhaps an easier method to perform than the one illustrated.

The tenotomy of the other recti muscles does not differ materially from that of the internal rectus, given above. The tendon of the rectus externus lies 2 to $2\frac{1}{2}$ mm. farther from the cornea, i. e. at 7.5 to 8 mm. A conjunctival bridge is not necessary here. The tendons of the superior and inferior recti lie about 6.5 mm. from the edge of the cornea, as before stated.

OPERATION OF ADVANCEMENT.—INTERNAL RECTUS. This muscle is the one most commonly advanced, as in operations for divergent strabismus. It is done as follows: An oval piece of the conjunctiva is dissected off between the edge of the cornea and the insertion of the tendon; the conjunctiva and sub-conjunctival tissue freely dissected up to liberate the tendon; one blade of De Wecker's double-hook is passed beneath the muscle, the other over it, beneath the conjunctiva, and the muscle is firmly grasped in the hook, lifted up and its tendinous insertion severed. A thread armed with three needles, as shown in Fig. 4, Plate LII, is inserted; the middle needle through the middle of the muscle far enough back to secure the desired traction upon it and the other needles through the conjunctiva and sub-conjunctival tissue above and below the cornea as illustrated. The muscle is again drawn forward, the sutures tightened a little, and as much of it resected as is desired by severing it at some point between the hook and the suture. The double thread passing through the muscle is cut close to the needle and the corresponding ends of the two threads thus formed are tied, forming two sutures, each of which pulls obliquely, but which, taken together, exert traction on the muscle

directly forward. In tying the threads the globe is rotated strongly inward and the muscle pulled toward the cornea. Care should be exercised to place the sutures so that they do not have a twisting action upon the eyeball. The primary effect of the operation should be a slight over-correction of the deviation, since the effect always diminishes in time. The reaction is rather severe, and cold or iced applications may have to be used to control the swelling and inflammation. The sutures may be left in place four or five days. It goes without saying that the operation should be made under strict aseptic precautions. Under cocaine it is not always free from pain; yet this is usually quite endurable. When a greater effect is desired the opposing muscle (*rectus externus*) may be divided, either of one eye or both. Instead of using De Wecker's double-hook the muscle may be raised upon an ordinary strabismus hook, the sutures inserted beneath the muscle before its tendon is severed, when the subsequent steps of the operation will be as above described. Or the tendon may be severed, the muscle allowed to retract, then seized with fixation forceps and drawn forward while the needle is entered through it. There is no danger of losing the muscle by permitting it to slip back after the tenotomy is made. Generally one or two assistants will be very useful, though it is possible to dispense with them.

The other *recti* muscles may be advanced in a more or less similar fashion, though operation upon them is less frequently necessary.

SECTION XXXIV.
SURGERY OF THE EAR.

CHAPTER I.
EXAMINATION.

General Considerations.—In examining a patient suffering from some form of aural disease it is necessary to inquire into the history and symptoms and also to make a physical and functional examination of both ears. The principal subjective symptoms to be inquired for in a given case are those of deafness, pain, tenderness, tinnitus, autophony, sensations as of obstruction or stuffiness in the ears, vertigo, headache, disturbances of gait or of vision and facial or other paralyses; also inquiring as to the nature of any existing discharge from the ear. The physical examination will consist of an inspection of the auricle or external ear, with regard to its normal relation to the canal and for the discovery of any existing inflammatory process or tumors. Congenital deformities exist in some cases, and may apparently operate to exaggerate any diseased condition.

The external auditory canal should next be carefully inspected through an aural speculum, by which means, with proper illumination, abnormal conditions existing therein may be discovered. Inflammation, swelling or tumors are among the affections of this portion of the organ. During this inspection the membrana tympani may be examined. Observation should be made with regard to its position, consistency or density, whether congested or not and whether intact or not. Next examine the Eustachian tubes, the pneumatic phases of the mastoid process, and other portions of the temporal bone contiguous to and connected with the tympanum. The hearing power of both ears should be tested in all instances.

Among the instruments necessary for complete examination of the ear are a head mirror in position, leaving both hands free, and a speculum for the purpose of concentrating the rays of light and dilating and straightening the walls of the auditory canal. In the absence of good daylight, a lamp, either one burning oil, an Argand gas burner, or, better, an incandescent electric light, must be provided.

Eustachian Tubes.—In the examination of the Eustachian tubes a Politzer bag and Eustachian catheter are necessary implements. If patulous the air injected through the Eustachian tube can be heard entering into the tympanum through a diagnosis tube made of rubber passing from the ear of the patient to that of the surgeon. The inspection of the drum membrane may be interfered with by the presence of foreign bodies in

the external canal, accumulations of wax, of exfoliated epithelium or purulent or other secretions. Where these are present complete removal of the foreign matter is imperative. This may be accomplished by douch-



Fig. 1047. Douching Ear with Warm Water.

ing with warm water through a properly constructed syringe, large enough to hold from two to four ounces and with a small, tapering spout, so that the view of the operator will not be obstructed. (Fig. 1047). The blunt curette or blunt hook and the slender, angular forceps, a slender probe, and a Siegle or pneumatic speculum are also necessary in the determina-

tion of motility in the drum-head, and for aiding in the discovery of small perforations of the membrane which may be obstructed by mucus or foreign matter.

Inflation.—Inflation of the tympanic cavity, through the Eustachian tubes, is accomplished by having the patient seated with his back to the light, the surgeon seated in front of him. An anterior rhinoscopic examination should be made by means of the head-mirror and nasal speculum. Obstructive growths in the nostrils may then be discovered and their position noted. If a simple inflation by means of the Politzer bag is to be accomplished the nose-piece of the bag should be inserted into the anterior nares of either side, the forefinger and thumb of the surgeon completely closing the nasal aperture around it. The patient is then instructed to lift the soft palate, thus closing the lower passage of the nose, and preventing the escape of the air downward. This is accomplished by an effort at swallowing or by blowing, as though to extinguish a lighted candle, or by the pronunciation of certain sounds, as of the letter "K," the examiner giving warning to swallow or to blow, as the case may be, and accompanying the patient's effort by a firm but careful compression of the air bag. If, for any reason, satisfactory inflation is impossible of accomplishment by this method it will be necessary to employ the Eustachian catheter. (Fig. 1048). The catheter, preferably made of hard rubber, with a distal curve and proximal funnel, should be held in the right hand, the thumb of the left hand tilting the tip of the patient's nose slightly upward; the curved end of the catheter is then carefully introduced along the floor of the nasal chamber, refraining from unnecessary force. When the end of the catheter has reached the posterior wall of the pharynx it should be turned in the direction opposite to the ear under examination and then withdrawn until the curvature meets the posterior edge of the nasal septum. It is then turned downward toward the ear under examination, and by encompassing an arc of about 180 degrees in the majority of cases the end will readily slip into the fossa at the orifice of the Eustachian tube. When convinced that this has been accomplished

the nozzle of the Politzer bag is inserted in the funnel end of the catheter and inflation accomplished by pressure. The catheter being properly provided with a ring at its proximal end, the surgeon should at all times be able to know and determine the exact direction which the distal point is presenting.

The diagnostic uses of inflation are many. In the first place the condition of the nasal passages and of the pharyngeal vault, the patency of the Eustachian tubes, perforation of the drum membrane and effusion within the tympanic cavity are determined thereby.

The patient may accomplish Valsalvian inflation by closing his mouth and tightly holding his nose, at the same time making a more or less strong expiratory effort until the air is felt by the patient or seen by the observer to inflate the tympanic cavity and alter the position of the membrana tympani. This method has been modified for safety by closing the external meatus with the forefinger; at the same time that the mouth is closed the nostrils are pressed together from either side by the ends of the thumbs.

Successful inflation may usually be known by an immediate improvement in the hearing, by alteration in the position of the drum membrana, by the sensation experienced by the patient, and by the sound felt by the patient and conveyed to the examiner's ear through the diagnosing tube or otoscope.

The immediately apparent advantage in the use of the catheter in place of the inflation by the Politzer method is seen where inflation of one tube alone is desirable, as by this means only can the entire force of the air current be expended upon one side. To avoid the danger attaching to the production of an emphysema the examiner should be careful to use no instrument having a sharp-edged distal opening. Violent or impatient efforts at the introduction should always be avoided, and the smallest possible amount of pressure from behind should be expended. By patient manipulation the end of the instrument will almost of itself, in many cases, find its way through into the pharyngeal space. In compressing the bag the examiner must be careful not to shove forward, thereby forcibly displacing the catheter from the Eustachian orifice. The withdrawal of the Eustachian catheter should be accomplished with the same care used in its introduction, the instrument being allowed to rotate until its beak points downward; the funnel end is then held tightly between the thumb and fore-finger, and drawn gently outward and downward in a curved direction, allowing it to rotate as it chooses during the withdrawal.

Tests of Hearing.—A crowning difficulty which arises in making accurate tests of hearing power is the inability to exclude the hearing from the other ear, especially where the hearing is affected on one side only. As deafness usually affects the proper perception of various kinds



Fig. 1048.
Eustachian
Catheter.

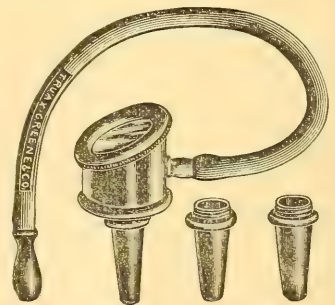


Fig. 1049. Siegle's Otoscope.

of sounds differently, it is, of course, necessary to use various tests to discover, if possible, variations in the perception of sounds of varying nature. The tests commonly used include the watch for testing common noises, the human voice, tuning forks for musical sounds of varying pitch, König's rods and various whistles (Fig. 1050) for testing the upper limit of perception. The accoumeter of Politzer (Fig. 1051) is perhaps the best test for purely mechanical, noisy sounds, inasmuch as it gives a practically uniform test. In testing the hearing it is important that the eyes of the patient be either closed or shaded, that he may not determine, through vision, from whence the sound comes or the nature thereof. The hearing power should always be tested by both air and bone conduction. When by air conduction the sound is heard louder than by bone conduction the condition of the hearing is either normal or the trouble is probably in the perceptive apparatus. If the sound is heard more distinctly by bone conduction we must suspect either derangement in the conducting apparatus or closure of the external meatus.

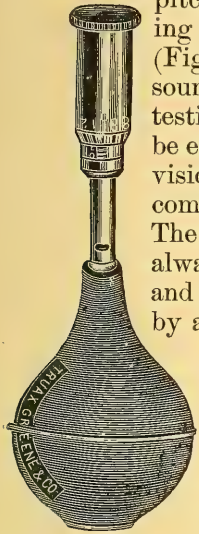


Fig. 1050. Delstanché's Whistling Pipe.

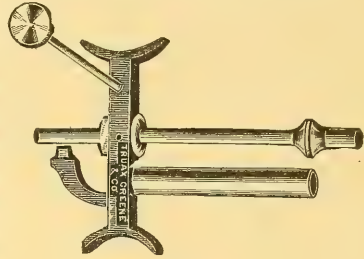


Fig. 1051. Politzer's Accoumeter.

In testing bone conduction the instrument used is applied to the forehead, mastoid process, zygoma, parietal bone (when one side only is to be tested), or to the vertex. When defective conduction of sound exists the hearing in bone conduction is increased, or louder, in the affected ear. Where defective perception exists the sound through bone conduction is diminished below the normal.

Hearing distance is usually expressed by fractions. The numerator denotes the distance at which the sound is actually heard and the denominator the normal distance at which the same sound should be heard. Cases exist wherein variations in hearing of a qualitative nature are found; that is to say, a patient may have difficulty in hearing a watch or other purely mechanical sound, even quite close to the ear, and still be able to hear the human voice in ordinary conversation quite readily. Or he may be able to hear the watch quite readily and still be unable to hear the human voice normally or distinctly at a reasonable distance, or to enjoy general conversation. Again, voice perception and noise perception may be comparatively good, and musical tones and sounds extremely defective, the sense of tone and pitch being lessened or destroyed. Both ears should be tested together, and also each separately. In testing both ears the surgeon should stand behind the patient. When testing one ear the eyes and the other ear should be closed, and the surgeon should stand at the side under test. The patient should be requested to repeat what he has heard, or thinks he has heard, after the examiner. It is, of course, obvious that voice tests are of no value if the examiner's lips are seen by the patient, owing to the fact that most deaf persons are more or less expert in lip reading.

CHAPTER II.

CONGENITAL MALFORMATIONS, INJURIES AND MORBID GROWTHS OF THE AURICLE.

Congenital Anomalies.—Congenital anomalies of the auricle are not exceedingly common, and perhaps are most frequently met with in the insane. Heredity, no doubt, has much to do with the production of these malformations, as members of the same family may have asymmetry of the auricles, and various abnormalities in size, location and position. The hearing function is not usually affected. There is an anomaly in which the auricle is so attached to the side of the skull that the lower extremity of the lobule points downward and forward, instead of downward. This is said to be a rather common occurrence in musicians. (Lombroso.) The various auricular anomalies are dependent upon some form of plastic operation for their relief.

Injuries.—Injuries of the auricle are not common, although incised wounds are occasionally met with. The resultant deformity may be seen in the case of emigrants coming from countries where the slitting of ears is a form of punishment for petty offenses. Should a recent case present itself the wound should be thoroughly cleansed and the edges brought together by sutures, these being inserted by preference upon the posterior surface of the auricle and passed deeply into the cartilage, but not through the integument upon the anterior surface. When seen too late for primary operation the edges of the wound must be freshened and sutured in the manner described.

Lacerated wounds of the auricle are much more common. This may result from pulling the ear. Koll cites a case in which the auricle was detached from the canal posteriorly. Lacerations of the auricle have been caused by projectiles, and not infrequently in severe physical struggles, as exhibited, for instance, on the football field. The lobule is quite frequently injured by ear rings being torn from the ear.

TREATMENT. The treatment of this class of injuries consists in thorough cleansing, trimming away of lacerated tissue, and, if practicable, uniting the wounded edges by means of sutures. If considerable inflammation exists a moist, cold antiseptic dressing should be applied for twenty-four or forty-eight hours, when the sutures may safely be introduced. When the case presented is an old one efforts must be directed to relieve the deformity by proper plastic operation. The injury most commonly met with is that resulting from a blow upon the auricle, producing a contusion. This may result either in an acute or chronic perichondritis, or a hematoma with or without fracture of the cartilages.

FROZEN EAR. Frozen or frost-bitten ear is often met with, especially in the colder climates. Prolonged exposure to cold may result in complete or partial necrosis. Efforts should first be directed to restoring the circulation and normal temperature gradually. The auricle should

be rubbed with snow or powdered ice. Following this a soothing emollient application, such as a mixture of olive oil and lime water, or a zinc oxide ointment, to either of which a small amount of extract of opium may be added. About the same line of treatment, with the exception of the ice or snow, is indicated in the case of burns of the auricle, either by intense heat or by chemical agents.

Perichondritis.—This may result from a contusion, but the majority of cases occur either idiopathically or following some inflammatory condition in the external auditory canal. The inflammation involves the entire auricle, with the exception of the lobule. A severe inflammation of this nature, causing necrosis of the cartilage, or forming sinuses on the surface of the organ, will produce great deformity, and is usually of long duration. The disease begins with a sensation of heat, gradually increasing to severe pain in the auricle. This is quickly followed by increasing vascularity and very soon by tumefaction, most marked upon the anterior surface of the auricle. Where the affection is the result of inflammation of the auditory canal all the symptoms are exaggerated.

TREATMENT. In the early stages treatment will consist in the application of cold compresses. If the inflammation does not subside and suppuration threatens early incision should be made, the tissues be thoroughly scraped, and the cavity packed with iodoformed or sublimated gauze, and a bandage applied. Gruening reports a case of prompt and complete cure in which several linear incisions were made completely through the auricle from its anterior to its posterior surface, through which slips of gauze were threaded, thus securing perfect drainage. He believes the disease may be avoided by this procedure and extensive suppuration prevented when used early.

MEDICATION. The internal remedies most often indicated in perichondritis are aconite, in the earlier stages, belladonna later, when active inflammatory symptoms have fully developed, arnica locally and internally, especially when caused by an injury or bruise. Hamamelis is also beneficial where the case results from traumatism. Kali iodatum and mercurius are frequently useful remedies; silica may also be necessary in the later stages.

Abscess of the Auricle.—Abscesses of the auricle are seen upon the auricular surface. They may result from contused wounds, punctured wounds or from the blocking of any of the sebaceous follicles. Usually these cases present very slight local symptoms, and unless spontaneous rupture occurs early a small incision will afford relief.

MEDICATION. The remedies usually indicated will include belladonna, calcarea carbonica, bryonia, arnica, cinchona, mercurius, pulsatilla, hepar sulphur, arsenicum, silica and sulphur.

Othematoma.—Othematoma is simply a hematoma of the ear, occurring without any history of traumatism. While generally agreed that this condition is found frequently among the insane the many authentic reports of cases occurring in persons of sound mind make it obvious that it is not of necessity an indication of mental disturbance. It is ordinarily unilateral, occasionally bilateral, and cases have been reported in which it has alternated from ear to ear. The tumor appears somewhat suddenly, and is commonly accompanied by burning or itching,

though it is rare for the patient to suffer from any general or local symptoms.

Effusion commonly takes place on the anterior surface of the organ and soon destroys the outlines of the various parts, with ovoid tumefaction covering the entire anterior surface of the auricle. The extravasated blood, if not evacuated spontaneously may be removed by means of aspiration, or incision, after which pressure should be applied. Massage of the tumor, together with aspiration, is a valuable method of treatment. The puncture with the aspirating needle should be made only under antiseptic precautions, and the wound carefully sealed, otherwise suppuration may ensue. If the blood is clotted and cannot be removed through the aspirator needle, or if, after puncture or rupture from any cause, suppuration has supervened, a free incision must be made. The line of incision should be so directed that it may be partially concealed beneath the margin of the helix, thus producing a minimum degree of deformity. When the sac has been laid open all clots should be removed, the necrotic cartilage sought for and scraped, or removed; and if the condition be an old one it is well to scrape the lining walls of the cavity to favor agglutination. Sutures may then be applied through the whole extent of the incision, excepting at the lower angle, into which some strands of horse hair or fine gut ligature may be inserted to favor drainage. Firm pressure is then applied, a favorable result being usually obtained.

Among the remedies liable to prove most serviceable may be mentioned arnica, belladonna (especially in the early stages with cerebral symptoms and evidences of disturbed circulation), arsenicum, hamamelis and secale cornutum.

Benign Tumors of the Auricle.—One of the most common benign growths in this region is the fibroid tumor, fibroma, or keloid. The growth is usually confined to the lobule. The negro race is especially liable to this neoplasm. The most frequent cause is the wearing of earrings or the piercing of the ears. The growth may attain the size of a pigeon's egg. The surface is smooth and hard to the touch. Usually these tumors are made up of white fibrous tissue; few cells can be discovered. Removal is ordinarily a simple matter; but they are liable to recur and frequent recurrence may be followed by malignancy. The tumor is circumscribed by the knife, which is made to pierce the entire thickness of the lobule, and is removed, care being taken to incise well into the healthy tissue. The wound is then closed by sutures and heals in a few days. If the growth be small it may be dissected out and the wound closed by sutures.

MEDICATION. Remedies which may prove serviceable in removing these tumors, or in checking their development, are calcarea iodata, baryta carbonica, conium, arsenicum, kali iodatum and silicia.

Atheroma.—Atheroma, wen or sebaceous cyst is the result of blocking of the sebaceous follicles. The tumor may rupture spontaneously, from the pressure incident upon its increase in size, or inflammation in the sac may ensue, resulting in the formation of pus. The lobule is the most frequent seat of this neoplasm.

TREATMENT. The treatment consists in enucleation, if possible without rupturing the sac. When the sac ruptures an attempt should be made to dissect it out after its contents have been thoroughly removed.

After curetting a thorough application of a solution of nitrate of silver to the cavity will prove efficient. The general health of the patient is much improved by the exhibition of the indicated remedy, as *calcareo carbonica*, *hepar*, *mercurius*, *arsenicum*, *kali bichromicum*, *silicia* or sulphur.

Angioma. This growth is rarely found on the external ear. Some instances, however, have been reported. Beneficial results have followed the injection of perchloride of iron. Similar to the *angiomata* are the *nevi vasculæ*, or the ordinary birthmarks occasionally appearing on the auricle and in the neighborhood thereof.

TREATMENT. The treatment will depend somewhat on the size of the growth. The ordinary simple port wine stains are best treated by puncture with the cautery, or, in case the vessels are larger and the growth presents the form of a circumscribed tumor, it may be incised. The operation must be performed rapidly, and the bleeding points thoroughly secured. This is readily done when the growth is limited to the auricle by the application of a clamp, so constructed that its pressure will shut off the blood supplied to the growth. The vessels may then be secured carefully and leisurely after the mass has been removed.

A cure is rarely effected by the use of remedies internally. Remedies which have at times been recommended are *lycopodium*, *kali iodatum*, *phosphorus*, *secale*, *thuja* and *pulsatilla*.

Malignant Tumors of the Auricle. **CARCINOMA.** This tumor, occurring primarily upon the auricle, is rare, it being much more common for the growth to appear at some contiguous point, involving the auricle by extension. The disease is most common in patients past middle life.

TREATMENT. The operative treatment consists in the complete removal of the neoplasm, preferably with a knife, though the galvanocautery loop has been used with success, amputating the entire auricle. In amputating the auricle the external canal is not to be obliterated during cicatrization. To prevent this the external meatus may be lightly packed with gauze, or a plug of metal or glass may be inserted into the canal while healing is in progress. When the adjacent glands are involved they should be thoroughly extirpated. If the growth is confined to the external ear and the canal is not involved the prognosis is much less grave than in malignant diseases in many other localities.

MEDICATION. The remedies employed are *arsenicum jodatum*, especially where no constitutional symptoms indicate a remedy, *mercurius jodatus flavus*, iodide of potash, in full doses, *aurum*, *hepar*, *calcareo carbonica*, *phytolacca* and *phosphorus*.

Sarcoma.—Comparatively few cases of sarcoma affecting the auricle have been reported. When uncomplicated by extension or involvement of the deeper portions of the ear the removal by means of the knife or the galvanocautery snare is easily performed, and the result usually satisfactory. *Arsenicum jodatum*, *mercurius* and *kali iodatum* are used. Other remedies may be indicated, as *aurum*, *conium*, *calcareo carbonica*, *belladonna*, *phosphorus*, *nux vomica* and *silicia*.

CHAPTER III.

DISEASES OF THE EXTERNAL AUDITORY CANAL.

Forms.—Inflammation of the external auditory canal is quite common, and may occur in one of three forms—circumscribed, diffuse and dissecting. These may be distinct, or one form may blend into another during the progress of the inflammation, so that any two or even all three forms may occur simultaneously.

Circumscribed External Otitis.—Boils, or phlegmon of the ear, are seen accompanying a general furunculous diathesis, or an impoverished or over-medicated condition of the system. They may also be symptomatic of constitutional syphilis or diabetes. They most commonly appear in the outer third of the canal, as this is the seat of the principal distribution of the small glands of the external ear. The disease seems to appear at times as an epidemic, more or less severe in character. It has been often noted in those who have been assiduously nursing the sick, and especially when accompanied by marked anxiety.

Aural furuncle may occur primarily, or may follow eczema or tympanic otorrhea. It is exceedingly obstinate when occurring symptomatically in syphilis or diabetes. It occurs most frequently in the young adult or during mature life. Sometimes the inflammation will extend and become diffuse. There is always, from the beginning, considerable pain, which increases until it becomes almost unbearable. There may be some elevation of temperature with pronounced tenderness to touch, preventing the patient's lying with the affected ear upon the pillow. The more deep-seated the abscess the more pronounced the symptoms.

Abscesses occurring in the bony portion of the canal often involve the periosteum, are extremely painful and are usually attended with considerable deafness and tinnitus. Examination with the ear speculum (Figs. 1052, 1053) will bring to view the circumscribed swelling. The prognosis is good. Syphilitic cases, however, present complications which make the prognosis more uncertain. Furuncles are exceedingly apt to recur. Hot water applied as hot as can be borne is always a safe and satisfactory procedure; laudanum may be added. A free incision affords quick relief to the sufferer. For the superficially located furuncles any sharp bistoury may be employed, but when the inflammation is deep in the canal one of several especially designed knives will be necessary; namely, Buck's bistoury or his furuncle knife, or Sexton's membrana

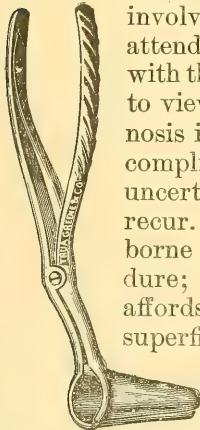


Fig. 1052. Plain Bivalve Speculum.

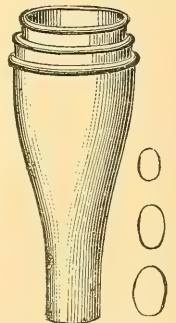


Fig. 1053. Gruber's Specula.

flaccida knife. After complete liberation of the pus and all inflammatory products the wound should be thoroughly cleansed and antisepti-

cally dressed. If exuberant granulations remain after the wound is otherwise closed they may be curetted, or dressed with powdered boric acid, or alcohol or pyoktanin solution may be instilled.

MEDICATION. The following group of remedies will furnish the indicated one in nearly all cases: aconite, belladonna, calcarea carbonica, calcarea picrata, ferrum picratum, ferrum phosphoricum, hepar sulphur, picric acid, pulsatilla, sulphur and tellurium.

Diffuse External Otitis.—This inflammation of the external auditory canal tends constantly to extend and involve the entire organ. It usually develops in the deeper portion of the canal, and extends toward the meatus. It may be primary, or an extension of inflammation from the auricle, tympanum, mastoid process, or any neighboring structure. It may result from debility or malnutrition, diphtheria, tuberculosis or syphilis. Deafness, tinnitus and pain are more marked and obstinate than with the circumscribed form, and the pain is especially severe in the diphtheritic form. The disease when syphilitic is slow and painful. A premonitory symptom is decided itching in the external canal, soon followed by tenderness and pain with swelling and all the attendant symptoms. In the acute stage of the disease fever of varying degree is usually found, with full, rapid, bounding pulse, restlessness and anxiety. Tenderness may be elicited about the mastoid and temporo-maxillary region, which is aggravated by mastication. Finally a sero-purulent or sanious discharge escapes from one or from several openings.

TREATMENT. The treatment will consist, first, of the local application of heat and moisture, which are the essential elements of a poultice. A careful irrigation of the canal with water as hot as the patient can tolerate and containing solutions of an anodyne nature, as laudanum, atropine, carbolic acid or menthol may be employed. Alcohol instilled into the ear has been recommended to abort the inflammation and to reduce the pain.

Depletion of the swollen and inflamed tissues is best obtained by incision. The spot most swollen and reddened being found by illumination of the canal, a deep free incision, carried to the bone, is usually



Fig. 1054. Buck's Knife.

promptly followed by relief of pain and general improvement. Either the bistoury or the furuncle knife of Buck (Fig. 1054) or meatus knife of Politzer, or the membrana flaccida knife of Sexton, may be selected. When this fails and the disease proceeds to suppuration, the discharge will at first be thin and sanious, but finally profuse and more purulent. Burnett advises the method of aspiration (with the Siegle pneumatic speculum) of the air in the canal, thereby bringing forth the pus from the openings in the sub-dermal abscess, and relieving the swelling, pain and inflammation, as well as cleansing and stimulating the parts.

Boric acid powdered, or boric acid and tincture of calendula, equal parts, evaporated to dryness and finely triturated (Sexton), boric acid and zinc oxide, equal parts, and methyl-violet, are among the most useful applications. These should be dusted carefully over the discharging openings in sufficient quantities to absorb the fluids, and should be frequently repeated. Should exuberant granulations appear they must be restrained by the application of nitrate of silver, using either the solid

substance or a saturated solution, or by alcohol as concentrated as the patient can endure. If polypi form they should be removed and their base curetted if necessary, and then touched by a caustic to insure permanent destruction.

MEDICATION. The remedies most frequently of use are aconite, arsenicum album, antimonium crudum, belladonna, calcarea carbonica, carbo vegetabilis, conium maculatum, ferrum phosphoricum, graphites, hepar sulphur, kali muriaticum, kali sulphuricum, mercurius, psorinum, silicia and sulphur.

Dissecting External Otitis.—This is an inflammation that enters the canal by dissecting the tissues, passing beneath them through and out of the canal without destroying its wall, and ultimately finding outlet on the surface at a point quite distant from the original site. This disease may occur as a complication of otitis media, with secretions in the tympanic attic, in the petro-mastoid antrum or the malleo-incudal nook, which do not find exit through the membrana tympani, but by a process of burrowing ultimately reach the outer surface.

Inspection of the ear drum and canal under illumination will discover the inflamed, swollen membrana flaccida. Pain is intense in the ear and over the corresponding side of the skull, and out of proportion to the deafness and other symptoms noticeable.

TREATMENT. The treatment will consist of antiseptic cleansing of the canal and membrana tympani. Following this a prompt resort to operative measures is indicated. In the early stages of the disease an incision may be made obliquely from behind the short process of the malleus, backward and downward following the posterior fold of the membrana tympani until the canal wall is reached; or a free incision may be made through the distended tissues of the canal well down to the bone and continued forward into the membrana flaccida. This operation is best performed by the Sexton knife, a narrow, long-bladed scalpel. The after treatment consists in antiseptic cleansing of the wound and canal, and suitable constitutional treatment. Following this the disease becomes properly one of the middle ear and should be treated accordingly.

MEDICATION. The same remedies usually valuable in suppurative affections are here to be considered. These include arsenicum, calcarea carbonica, belladonna, calcarea fluorica, hepar sulphur, mercurius, silicia, sulphur and tellurium.

External Parasitic Otitis.—Various names have been applied to this affection, a few of which are otomycosis, a name first suggested by Virchow, aural fungi, fungous otitis, aspergillus of the ear, ear mould. It may be of an intense nature, producing the most severe suffering, or it may be so mild that the patient's attention will not be attracted by it. The more severe cases are usually attended by the growth of aspergillus niger, and the milder form by the aspergillus glaucus. The former parasite being the larger, the distinction is sometimes made as aspergillus major and minor. The disease is most apt to occur in those who have recently recovered from an ear inflammation, either suppurative or desquamative. It may develop after the instillation of fats or oils into the canal.

The symptoms usually complained of by the patient are itching, stinging, deafness, more or less pain, a watery discharge, and a feeling of

stiffness, as though the ear contained a cotton plug. The objective symptoms or physical signs, both macroscopic and microscopic, are quite characteristic. In an early examination under illumination the auditory canal, the injected myringal blood vessels and the plaque of mycelium forming upon the drum-head may be plainly seen. Later, the drum-head and the wall of the canal may be seen covered with a substance much resembling wet, dirty newspaper or blotting paper, with small spots of various colors, black, green, brown or yellow. This mass may be mistaken for a foreign body, an epithelial plug or cerumen. If the lardaceous mass be removed the raw tissue of the corium may be readily recognized, and after drying the surface with absorbent cotton the recurrence of the exudation may be seen going on under the eye of the observer. This removal should be accomplished during the stage of the disease when the pseudo-membrane is lying loosely upon the drum-head or wall of the canal, at which time it may be removed without resulting aggravation.

This deposit should be distinguished from cerumen by the dark brown color, the solidity and dryness of the latter, and by the absence of such pain and inflammation as is usual in otomycosis, and also by the fact that cerumen is readily softened and dissolved by the application of glycerine, fluid cosmoline or warm water. The conclusive test in making an accurate diagnosis is, of course, the microscopic observation of a portion of the deposited material; and cultures of the spores may readily be made and afterwards subjected to thorough microscopic examination. The prognosis is usually good; complete cure under proper treatment is the rule.

TREATMENT. Treatment will consist in checking the growth and in removing the mould. Ordinarily, careful syringing with warm water, or water and alcohol, will dislodge most of the growth. (Fig. 1047). That remaining may be removed by wiping with a cotton pledget upon the end of a cotton carrier, or on delicate forceps. It is best, however, where possible, to avoid the application of instruments to the inflamed surface and to continue the application of the selected germicidal solution for a few days, which will destroy the remaining spores, when they may be readily removed by again syringing the ear.

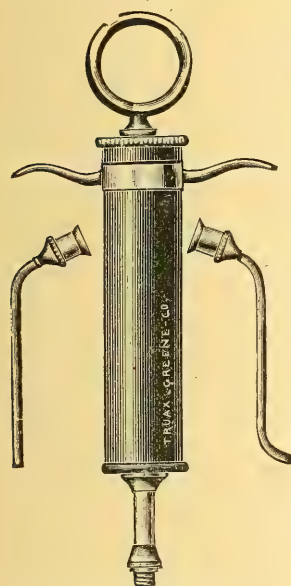


Fig. 1055. Blake's Middle-Ear Syringe.

The medicinal applications recommended for the destruction of these growths are exceedingly numerous. Usually it is better to apply the medicament in powdered form, as there is always considerable liquid connected with the development of the mass. Alcohol, either alone or in combination, is a most valuable application to desiccate and destroy the growth and is useful in allaying the inflammation, especially if there be granulations present.

Before applying the alcohol it is best to syringe the canal with an alkaline solution, thus removing all fats and oils that may be present. The alcohol should be sufficiently strong to destroy the parasite, and still sufficiently diluted to avoid excessive irritation and pain. The amount

of this dilution will vary in different cases. The addition of two per cent. of salicylic acid to the alcohol has been recommended by competent observers. Burnett, of Philadelphia, recommends a powder consisting of chinoline-salicylate one part and boric acid eight to sixteen parts. It is both convenient of application and efficient. If the subsequent inflammation be eczematous a powder of equal parts of starch and oxide of zinc is efficacious. Theobald recommends a finely triturated powder composed of equal parts of boric acid and zinc oxide. Solutions of permanganate of potash (one to two per cent.), of tannin, bichloride of mercury, carbolic acid, hypochloride of lime (two grains to the ounce), nitrate of silver (ten to one hundred grains to the ounce), and a saturated solution of tannic acid in Listerine, are among many that have been highly extolled. The latter solution has proven most efficacious in the author's experience.

Malignant External Otitis.—Malignant disease may develop primarily in the ear, but it is more frequently secondary and usually originates in the auricle, the middle ear, or the mastoid, from whence it invades and often totally destroys the canal. It sometimes appears to have been the result of some mechanical irritation, such as violent scratching of the ear with a hard instrument, as a pin or a metal ear spoon. It has been known to originate in a wart or an ulcer. The growth may take the form of an adenoma or a carcinoma. Although metastasis is liable to occur in the surrounding lymphatics this does not always appear, and it will not do to depend upon it as an ever-present diagnostic sign.

DIAGNOSIS. Usually this disease is highly malignant; occasionally it is but slightly so. Cases have been reported of undoubted carcinoma wherein extirpation has been followed by immunity.

TREATMENT. If the case reaches the surgeon early enough the growth should be removed. If it returns the major portion of the membranous lining of the canal should be sacrificed. If resort to the knife be refused or contra-indicated the growth may be removed with nitric or concentrated lactic acid, or the electro-cautery. In cases where there are ulceration and offensive discharge, especially in old or debilitated patients, Burnett recommends the application of the following:

Cocaine muriate.....	half drachm
Caustic potash.....	$\frac{1}{2}$ to 1 drachm
Petrolatum.....	2 drachms

The skin should first be cleansed and a small amount should be applied at a sitting. It should be thoroughly rubbed in. As destroyed the tissues should be removed lest they touch and cauterize healthy tissue. In many cases all methods of treatment will prove but palliative. Homeopathic remedies that may have proven useful in the treatment of similar malignant growths in other locations should be given a trial.

CHAPTER IV.

FOREIGN BODIES AND OSSEOUS TUMORS IN THE EXTERNAL AUDITORY CANAL.

Anatomical.—Ordinarily the removal of foreign bodies from the external canal should present no difficulty to the surgeon accustomed to work with reflected light. Often the greatest damage done by a foreign body in the ear is that caused by frantic and futile efforts in attempts at removal. The form of the external canal will explain the nature of the injury produced by unskillful manipulation. The external portion is wide, slopes somewhat upward and merges into a contracted or narrower part. This is followed by a second capacious portion, which, in turn, slopes downward. Children form the majority of those suffering from the presence of foreign bodies, as pebbles, beads, peas and cherry stones, pieces of slate pencils, orange pits, etc. A safe axiom may here be stated, that a foreign body in the ear can do no harm if undisturbed, unless it consists of material of an irritating nature. Politzer reports finding a piece of slate pencil which had lain in the canal for fifty years, with no permanent injury resulting.

Treatment.—When the patient is seen before futile attempts at removal have been made the foreign body will usually be found in the outer distended portion of the canal or pressing against the constricted portion. If the confidence of the child can be obtained so that it will remain quiet while the speculum is introduced an anesthetic will not be necessary, as no pain or even discomfort attends the removal. The nature of the object will require some variation in the methods and instruments required for its removal. A blunt hook or curette should be inserted between the body and the

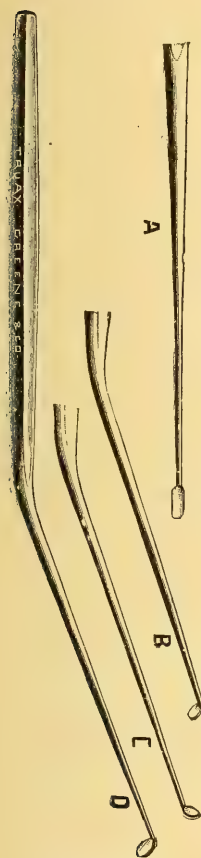


Fig. 1056.
Ear Curette.

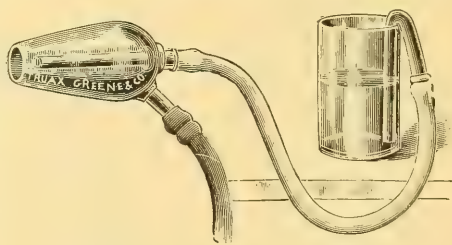


Fig. 1057. Lucae's Ear Douche.

wall of the canal, usually above, and gentle traction should then be made outward. (Fig. 1056). The use of the syringe in this class of cases when under the manipulation of one skilled in aural surgery should be avoided if possible, the removal with the hook or curette being quicker, simpler and safer. The syringe will serve to drive the body further into the ear

primarily, though it may eventually effect its removal, and it is possible in thus forcing the body more deeply in the canal to accomplish unnecessary irritation and injury. In the case of adults in considering this class of foreign bodies no anesthetic need be given.

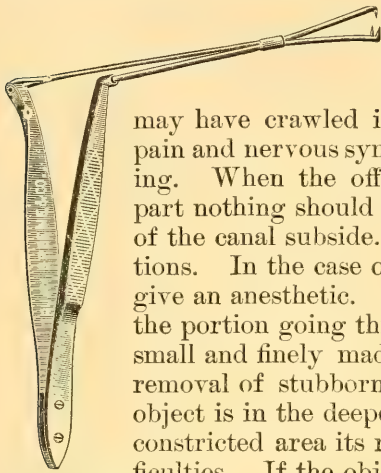


Fig. 1058.
Angular Ear
Forcep.

If a bean or pea find lodgment in the outer ear it will swell and produce pain and discomfort; it should be removed at the earliest moment. Insects which may have crawled into the ear will often produce agonizing pain and nervous symptoms. They can be removed by syringing. When the offending object is wedged into the narrow part nothing should be done until all swelling and inflammation of the canal subside. This may be hastened by hot fomentations. In the case of children it is here usually advisable to give an anesthetic. Angular or rectangular forceps, in which the portion going through the speculum into the canal is very small and finely made, are most desirable instruments for the removal of stubborn foreign bodies. (Fig. 1058). When the object is in the deeper dilated portion of the canal beyond the constricted area its removal presents the greatest array of difficulties. If the object is small enough to pass through readily it may be easily syringed out. If the surface is ragged and uneven, and if syringing fails to remove the body, it should be rolled gradually toward the external opening with the flat blunt-hook, but if it have a smooth surface, as a glass bead or a polished coral, it will be best to adhere to patient syringing. The forceps should never be used on a smooth, glistening surface.

Where violent efforts have been made for the removal of the foreign body and the canal walls have been lacerated and the membrane ruptured, acute inflammation of the middle and external ear may ensue and be accompanied by considerable bleeding.

If it is impossible, even when the patient is under an anesthetic, to remove the object which has been forced through the constricted portion of the canal, a most troublesome complication is met with. In some cases it may be wise, where the foreign body is of resisting material, to allow it to remain, simply keeping the ear clean by careful syringing. This has been followed, in some cases many months later, by the comparatively easy removal of the offending object. Where the foreign body is tightly wedged in the cavity of the tympanum, having perforated the drum-head, an anesthetic should be administered and careful effort be made to detach

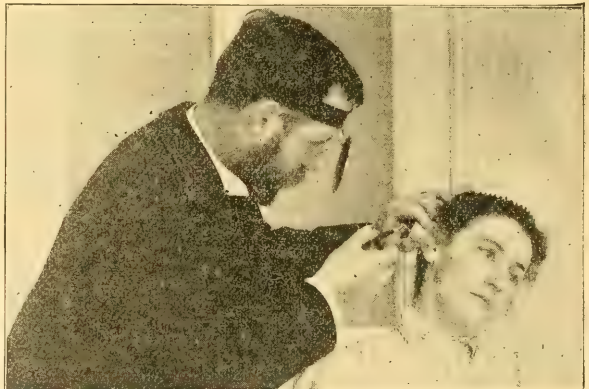


Fig. 1059. Operating With Angular Curette.

and remove it. Occasionally the continued presence of the foreign body causes intense and constant pain, and at times pronounced symptoms of cerebral irritation. It may be necessary, in this class of cases, in order to reach the object and facilitate its removal, to detach the auricle from the side of the head. This is done by incising from behind and laying the auricle forward upon the cheek. By this means the operator is brought closer to the object and its removal is facilitated.

Exostosis.—An exostosis is a bony tumor which arises by a more or less broad base from the posterior wall of the canal at the point where the bony and cartilaginous parts join. At the outset there is apt to be a sub-periosteal abscess over the mastoid, which makes its way into the meatus through the line of least resistance, usually coming out between the osseous and cartilaginous portions of the canal, through which opening it will discharge for sometime. Later, vascular, granular-like growths appear at the opening of the abscess and increase in size, while at the same time they gradually change into bony tissue by slow conversion into bone cells.

TREATMENT. If the base is not broad, or should there be a pedicle and the growth be somewhat movable, an anesthetic may be administered and the growth detached by a gouge and removed by a pair of rectangular forceps; but if the base is broad and the tumor firmly fixed the best means for its removal is the use of a dentist's drill; a few turns at the base of the tumor will usually detach the growth. It is best to operate with reflected light.

Hyperostoses.—These are of intense and ivory-like hardness, and their removal is attended with great difficulty because of their density and because they are more deeply seated in the canal. Hyperostoses are much more commonly met with than exostoses. Hyperostoses are usually multiple, while an exostosis appears alone. The hyperostoses frequently appear as three pyramidal eminences, meeting at their apices at the central axis of the lumen of the canal. The formation of these tumors is painless, they appear without the knowledge of the patient, and often are discovered while submitting to examination for other conditions. Both ears are usually affected simultaneously.

Occasionally the growth will stop and the tumor will remain the same size for a long period. These cases should never have the ear syringed; if water gets behind the growth it may be retained, thus producing considerable deafness, great irritation and at times suppuration. The patient should also be warned against sea bathing, diving, or ducking his head in the water in bathing.

It may or may not be wise in any given case to proceed to the removal of these hard, ivory-like, osseous tumors. Generally the only inconvenience is that attending the retention of wax, or of water or liquids introduced into the ear, which conditions may be prevented by care, or the result readily removed by proper attention. Where they continue to grow slowly and eventually threaten to close the external canal removal is necessary for the relief of the deafness and annoying sensations. While there is a fairly good opening between the tumors, or between one

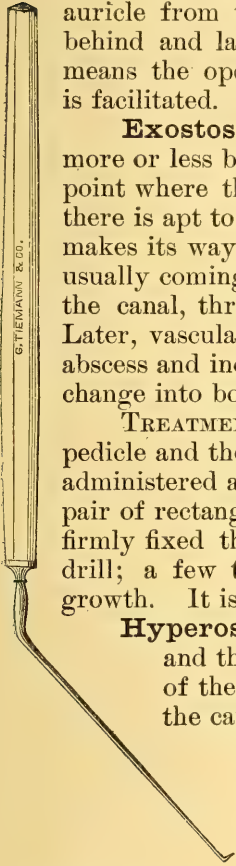


Fig. 1060.

Angular Ear Hook.

growth and the canal-wall, and if there be no pain and no discharge or passage of air through the tympanic membrane during inflation with a Politzer bag, they should not be operated upon.

If the tube is occluded sufficiently to interfere materially with the entrance of sound vibrations, or if perforations exist, discovered by inflation, accompanied by purulent discharge, the patient may be considered in a perilous condition; the discharge having no free exit, the growth must be removed for drainage and to diminish the risk of cerebral meningitis.

TREATMENT. The patient should be in a horizontal position and properly placed for illumination and necessary manipulation. The operation being a slow one the surgeon should be seated and the operating table should be a trifle higher than

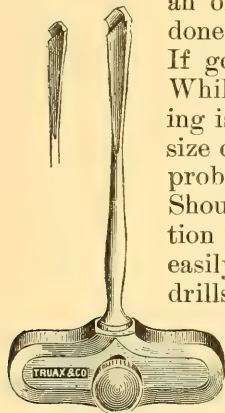


Fig. 1061.
Buck's Mastoid Drill.

an ordinary writing table. The work should be done with reflected light from a forehead mirror. If good daylight can be obtained it is the better. While the patient is anesthetized and before drilling is begun a careful estimate of the shape and size of the growths should be obtained, a simple probe being used in examination. (Fig. 1062). Should the examination reveal a pedicle the operation is decidedly simplified, as the pedicle can be easily ground through with ordinary cutting drills. It is usually best to bore a hole through the pedicle, enlarging its opening toward either side, afterwards cutting first from one side then from another until the cuttings meet at the central hole. The growth being detached, it can be removed from the meatus readily with forceps. Ordinarily the base is



Fig. 1062.
Metal Ear
Probe.

broad, in which case an opening should be drilled into the center of the growth and enlarged with fissure-burrs, using larger burrs as the opening is made larger. It has been found advisable to limit the revolutions of the drill to about twenty-five hundred per minute, as this prevents heating by rapid friction.

Before the removal of a hyperostosis is attempted the patient should be warned that immediate relief of deafness will not ensue, certainly not until the swelling following this operation has subsided. On recovering consciousness the patient will often experience pain, which must be relieved by hot fomentations. If bone granulations appear and do not voluntarily subside their removal may be effected by the daily application of gallic acid, insufflated into the ear with a tube, after cleansing and carefully drying it with absorbent cotton.

Neoplastic Narrowing and Closure of the Meatus.—This is not a disease, but, more properly speaking, an abnormality. The canal is frequently found closed in congenital malformations of the auricle. In these cases, there being no hearing, it is useless to make a permanent opening. Cases have occurred, however, where the malformation has been confined to the external ear and children have had sufficient hearing power to acquire speech. Attempts have been made toward producing a perma-

nent opening. The author has been unable to obtain reliable data describing any case followed by success.

When the external canal has been acutely inflamed and there has been a profuse, purulent discharge a firm cicatricial tissue has been known to form at the orifice, closing or partially closing the canal. Occasionally this circular band is found about a quarter of an inch within the canal. The surface is red and glistening. Various methods have been devised to keep the canal open after incision and dilatation. Pieces of rubber catheter, pledgets of lint and sponge tents have alike failed to preserve the opening. As soon as they are taken away a new growth invariably returns. The commonest form of constricted meatus is the result of prolonged eczema. In severe case the opening is so narrowed that it will admit only the smallest probe. The usual subjects of this disease are old, gouty persons who have had a chronic, general eczema, to which no attention has been paid. In fact, the existence of the constriction of the meatus is due to negligence. As the patient grows older the infiltration of the tissue increases and the lumen of the canal becomes smaller. Eventually complaint is made that the ears are closing. In this class of cases, if the patient will submit to proper cleansing and the rules of diet necessary to combat the gouty tendency, and allow soothing applications to be made to the eczematous tissue, hearing may be retained. Attempt at forcible dilatation produces an aggravation of the trouble, and ensuing inflammation frequently closes the little passage remaining. In some cases a silver tube may be constantly worn with considerable advantage. This should not be resorted to where the constriction is the result of inflammation, as the presence of the tube will excite irritation. Where there is complete occlusion of the external meatus we can only speculate as to the condition of the deeper parts. Consequently operative measures are not justifiable unless distinct evidence of otherwise useful hearing is obtained.

CHAPTER V.

INJURIES AND DISEASES OF THE MEMBRANA TYMPANI.

Etiology.—Injuries of the drum-head are ordinarily produced, first, by sudden condensation of air in the external canal or the middle ear; second, by fracture of some of the cranial bones which extend to the drum-head; and third, from penetration by a foreign body.

Rupture of the membrane sometimes occurs from the rapid rarefaction of the external atmosphere; for instance, during the use of the pneumatic otoscope. In such cases, and also where rupture occurs during inflation of the middle ear with the Politzer bag, it is probable that atrophic changes have previously occurred in the membrane. The most frequent cause of injuries to the drum-head is the extremely bad habit of scratching the ears with hair pins, ear scoops and the like, the instrument being accidentally thrust too far. The membrana may be entirely destroyed by unskillful attempts at removing a foreign body. Blows upon the ears, diving, surf bathing, discharge of cannon, gun-shot wounds, a kick on the mastoid process and hanging by the neck may cause rupture. The drum head may be ruptured also during a violent attack of vomiting, or of sneezing or coughing. In such cases a catarrh of the middle ear, with more or less stenosis of the Eustachian tube, or some atrophy or sclerosis of the drum head will usually be found. It has been proven by experiments upon the cadaver that it is extremely difficult to rupture the normal membrane. Some writers contend that the membrana flaccida, or Sharpnell's membrane, aids in preventing rupture, owing to its being less tense than the membrane proper. When the injury is direct the shape of the rupture will depend upon the instrument causing it. When occasioned by a blow or fall there may be concussion of the labyrinth, with considerable deafness. In these cases, as well as in those ending in inflammation and suppuration, disturbance of hearing frequently remains after the rupture is healed. The effect of the discharge of fire arms is not produced altogether by the shock of the explosion but by the action of sonorous waves transmitted directly to the membrana tympani. A popular practice of facing toward the mouth of the cannon and of slightly opening the jaws and lips when the discharge occurs is perhaps the best general safeguard from the accident. The discharge of fire arms may produce deafness with subsequent noises, together with other functional disturbances of a reflex nature, without at the same time producing rupture of the drum-head.

Prognosis.—The prognosis of traumatic lesions of the ear depends considerably upon the nature and course of the injury. When thickening and adhesion of the drum-head or concussion of the labyrinth occur, with or without rupture of the membrana tympani, permanent disturbance of hearing is likely to result.

The medico-legal significance of injuries becomes of special importance to the otologist who is called upon in court for expert testimony as

to whether or not the hearing has been injured. In order to decide definitely that a rupture is of traumatic origin it is necessary that the membrana tympani be examined immediately after the alleged accident; because if suppuration has already begun at the time of the operation it will be almost impossible to decide that the case is one of traumatism. In labyrinthine diseases, where the external meatus and drum-head appear normal, it is impossible to make a positive diagnosis, as the question must be determined by the answers the patient gives when testing the hearing with a tuning fork and Konig's rods. Bone conduction of the sound waves is diminished or entirely wanting in such cases, and the patient complains of tinnitus, vertigo, deafness and a general full feeling in the head. When a patient complains that while hearing well a blow was received on the ear which caused subjective noises, pain and even vertigo, and that hearing was soon found to be defective in the injured ear, and when the drum-head is normal but hearing by bone conduction of sound from the tuning fork is less distinct than when heard through the air, the probabilities are that the patient is suffering from a concussion of the labyrinth. But when these conditions do not exist and there is no existing evidence of injury, with evidence of middle ear disease, the aurist should be extremely guarded in giving his opinion.

TREATMENT. In simple rupture of the drum-head from injury syringing the ear and instilling fluids must be avoided. It is best to protect the injured ear with a piece of cotton wool, worn constantly. When the injury produces inflammation and suppuration of the membrana tympani and middle ear the same treatment is indicated as in acute otitis media. The application of a constant current of electricity has proven beneficial in improving the hearing distance and in lessening the tinnitus in cases of labyrinthine concussion. Permanent disturbances of hearing and subjective noises will often remain in spite of all treatment.

Epithelial Growths of the Membrana Tympani.—These are rare. Tubercles are occasionally found upon the membrana, appearing as reddish-yellow spots, averaging the size of a pin's head, and occurring during milliary tuberculosis. Granulations are sometimes observed upon the membrana in cases of chronic myringitis and acute purulent otitis, but are most commonly found in cases of chronic middle ear disease and are associated with polypoid growths.

POLYPI. Polypi are divided into four varieties: first, mucous polypus; second, fibroma; third, myxoma; fourth, angioma.

The mucous polypus is the one most frequently seen, and is due to a hyperplasia of the mucous membrane. It is composed of a fine, delicate stroma of areolar connective tissue, containing round cells in its meshes and sometimes spindle-shaped cells. Fibromata are much more dense and tough than the mucous variety, are less vascular and consist of firm connective tissue containing spindle cells.

TREATMENT. Granulations and polypi, when seen early and when small in size, may be cauterized with nitrate of silver, with a drop of the tincture of chloride of iron, or with chromic acid fused on a probe. When large and of long standing and when pedunculated their removal by operative means will be necessary. The simplest method is by the use of the wire snare, following removal by cauterization of the stump. In using strong acids or caustic nothing but the growth should be touched.

The curette may be useful in some cases in removing exuberant granulations upon the drum-head.

Diseases of the skin at times extend to the drum membrane. Vesicles of pemphigus and eczema may occasionally be found upon the surface. Calcification, or deposit of lime upon the drum-head, is sometimes seen as an independent affection, the hearing being normal, the middle ear not being affected. It is more common, however, in cases of chronic suppuration, otitis media, and has been seen in the non-suppurative form.

Acute Myringitis.—Acute inflammation of the tympanum may affect the drum-head in part or in its whole extent. It may be caused by exposure to the direct influence of cold wind, cold applications or sea-bathing. Usually the dermal layer is alone involved, but in severe forms an abscess in the deeper portions of the membrana tympani may follow, making it difficult to distinguish it from acute otitis media. There is moderate pain in the ear in milder cases, though severe, sharp pain may attend upon deep abscesses. Occasionally there occur a pulsating noise and more or less tinnitus. The hearing is less affected when the middle ear is uninvolved, and the course of the disease is much more brief. In the mild form recovery is usually the result. The more severe cases may become chronic, or the inflammation may extend and involve the middle ear.

TREATMENT. This will consist of the employment of ordinary antiphlogistic measures, and if severe pain exists anodynes may be necessary. As this affection often merges into acute otitis media the treatment will be much the same as in the latter affection.

Acute Otitis Media.—Acute otitis media is divided by many authorities into two varieties, acute catarrhal and acute suppurative otitis media. It is often difficult to make a distinction. Acute catarrhal otitis is the most stubborn variety. This form of inflammation is commonly called earache in children, and is most apt to develop from a common cold. Some children seem subject to frequent attacks. It has been particularly common through the past five years, owing to the existence of epidemic influenza, or la grippe, as a causative factor. It is frequently seen in the course of acute infectious diseases, as measles, scarlet fever, whooping-cough, diphtheria, and also in tuberculosis, cerebro-spinal meningitis and in syphilis. Acute inflammation of the middle ear has been caused by the use of a nasal douche, and by voluntary "sniffing" of watery solutions for the relief of nasal catarrh; the fluid entering the Eustachian tube and middle ear institutes acute inflammation. Teething children are very commonly attacked by catarrhal otitis media, and we should constantly keep in mind the nerve supply of the middle ear and the teeth on account of their intimate relationship. The teeth should be examined properly, in cases of acute inflammation of the middle ear, to determine the presence of irritation from decayed roots. Sea-bathing is an extremely common cause of this form of ear inflammation. The membrana tympani may be ruptured in diving or from the force of a wave against the side of the head; or acute otitis may be caused independently by rupture, by entrance of cold water into the auditory meatus, or through the nose and Eustachian tube into the ear.

SYMPTOMS. The symptoms will depend upon the intensity of the inflammation. With a "cold in the head" there is, first, a dullness or

fullness in the ear, succeeded by sharp, lancinating pain, usually more severe at night. Infants will scream and put their hands to their heads. The pain often radiates about the ear and side of the head, at times shooting toward the teeth. There is usually some fever, especially in children who suffer from delirium and convulsions. The pain may be due to the inflammation or may be owing to the closure of the Eustachian tube, preventing ventilation of the middle ear, in which case it is caused by atmospheric pressure on the surface of the drum-head, causing retraction of the membrana. If not relieved by inflation and treatment naso-pharyngeal inflammation of the middle ear is apt to follow. Pain is complained of during coughing, sneezing and upon eructation. There is usually present an annoying tinnitus of a rushing, ringing or pulsating character.

Autophony annoys the patient. Small tough lumps or plugs of mucus, clogging the fenestræ, will produce a high degree of deafness. The pain of acute catarrhal otitis, especially in children, is apt to come on during the night, while in the day-time there may be no earache. Children subject to frequent attacks are often neglected by their parents who think an earache to be of no importance, and that it will pass without the need of professional advice. Were these cases properly treated early in life fewer of the incurable forms of chronic catarrhal deafness would present themselves. Every general practitioner should include among his instruments an otoscope, an ear speculum and a Politzer bag, at least, and possess sufficient knowledge to diagnose and abort these simple forms of ear disease.

This acute ear affection will frequently be due to adenoids in the post-nasal cavity, especially so in children poorly nourished or debilitated. It is of the utmost importance in all cases of ear disease that a careful examination of the naso-pharynx be made. The natural difficulty in obtaining a view of the regions involved makes a digital exploration necessary. This should be made by passing the index finger, properly guarded from the teeth by a broad rubber band, into the mouth of the patient and behind the soft palate, thereby carefully determining existing conditions. The growths are generally of a bright red color, varying in size from that of a small pea to that of a hazel-nut. They may exist in groups or separately, and are usually of a soft consistency. There is present a peculiar expression of the face and also a peculiar pronunciation of certain words, being spoken, as it were, "through the nose," the resonance of the voice being imperfect. The sounds M, N and ING are particularly difficult of pronunciation. The facial expression is that of sadness, there being a decided lack of tone in the play of the features. The long-continued mouth-breathing permits the nose to assume a sharp outline, looking pinched.

Adenoid growths are most frequently found between the ages of three and twenty years. They should always be removed, whether affecting the hearing or not, as improvement in general health follows. When the surgeon possesses a moderately long and aseptic finger nail the growths may be scraped away while making the digital examination. When this cannot be accomplished an annular, or ring-shaped, knife is to be used. This instrument held in the right hand is passed behind the soft palate and into the vault of the pharynx. The growths being carefully engaged within the diameter of the circular knife or curette, a gentle shaving

motion removes them effectually. There is sometimes considerable hemorrhage which is controlled by cold applications, hemostatics or tampons.

Another method of removal is by means of the post-nasal forceps. Force should never be exerted. The finger should be frequently inserted until it is determined that the cavity is entirely clear. The operation should be done under an anesthetic, the child being placed in a good light and seated nearly upright in the lap of an assistant, the operator sitting directly opposite. In many cases it will result in a prompt and permanent cure, though at times the removal of the growths is accomplished with great difficulty. When found in adults every trace of the diseased tissue should be removed before the case is pronounced cured. Following the removal, attention must be paid to the Eustachian tubes, the middle ear and the membrana, as more or less change will have occurred in these organs. It is frequently necessary after the removal, particularly when the growth is large, to cauterize the base from time to time with nitrate of silver or chromic acid.

In mild cases of acute catarrhal otitis media the hyperemia of the drum-head is slight and most marked along the handle of the malleus. In the more severe cases the injection of the vessels is more intense and the membrane may be of a very angry livid color. Frequently there is bulging of the membrane, due to inflammatory infiltration or to the presence of fluid in the tympanum. The pain may last only a few hours, or may continue several days. The attack will be more prolonged in patients addicted to the abuse of alcoholic stimulants and in those debilitated and subject to catarrh.

TREATMENT OF ACUTE OTITIS MEDIA. Blood-letting by cupping or leeching still retains its hold upon some otologists. Local bleeding over the mastoid region will produce temporary depletion of the vessels over the mastoid and those anastomosing with the tympanic vessels. The scarificator and cupping glass have proven most satisfactory where the operation of local depletion is indicated.

Poulticing of the ear should always be avoided, being an obsolete and dangerous practice. Hot water poured into the meatus will frequently relieve the pain with promptness. Boric acid may be added to the water for this purpose. Lucae's glass douche is an ingenious double glass tube, connected by rubber tubing with the douche cup and so constructed that the stream of water passes in through one part of the apparatus and is carried off by another portion into the basin below. (Fig. 1057). In the milder cases it may be necessary only to inflate the middle ear by the bag alone or by the use of the catheter. In fact, it is a good rule, when a patient is seen early, to thoroughly and carefully inflate the middle ear through the Eustachian tube. The indicated remedies should be given early and be followed up with persistence. The patient should be kept quiet and given a light diet.

Where inflammation of the pharynx or nares exists these parts should receive proper attention in the form of soothing sprays. The pain in the ear may frequently be controlled by the instillation of a solution containing atropia sulphate two grains, acid boric, ten grains, and aqua half a drachm to a drachm, or a four per cent. solution of cocaine hydrochlorate. The use of quinine must be avoided in all cases of acute

inflammation of the ear. Patients in the habit of aborting so-called head colds by taking large doses of quinine should be cautioned against the practice as it decidedly increases the tendency to acute or chronic catarrhal otitis media. Attention to the general condition of the patient is always wise. Judicious bathing, proper exercise, avoidance of damp or wet feet and of sudden changes of temperature are all conditions to be advised. Where decided bulging of the membrana tympani, indicating the approach of perforation is found, it should be promptly and carefully punctured with a paracentesis needle. The design of Politzer, either straight or angular is practical and satisfactory, and rather superior to others. The operation should be accomplished under thorough illumination only and the head of the patient should be held by an assistant. The point punctured is usually selected at the posterior inferior quadrant, although it is generally best to puncture at the most prominent point of bulging. After puncturing, when the mucus fails to escape easily, it may be necessary to drive it out of the tympanic cavity by Politzer's method of inflation. The operation is not attended with favorable results in tuberculosis or weak subjects, as the course of the affection is a chronic suppuration of the middle ear with all its attendant consequences. Politzer cites cases wherein the operation was performed upon one ear and the other treated strictly without incision, in which the latter procedure was followed by much more satisfactory results. The remedies most frequently of use in this form of middle ear disease include belladonna, chamomilla, gelsemium, hepar sulphur and pulsatilla.

Chamomilla will be found especially helpful for earache occurring at night. The child is fretful, cross, cries viciously, wishes to be carried, because easier when held and supported.

Belladonna is useful when the pain is so severe as to threaten convulsions. The child's head is hot and congested, its extremities are cold, and the paroxysms of pain come on quickly, subsiding as suddenly as they came.

Magnesia phosphorica is a remedy of first importance in violent paroxysms of neuralgic pain. It is given most advantageously in the low potencies and in hot water. The pain is better from warmth.

Pulsatilla often relieves earache where apparently better indicated remedies fail. The child is limp and lifeless from its suffering. The pain exhausts its vitality and creates disturbances of its digestive organs.

Gelsemium will often relieve where belladonna fails, and is to be used where brain complications threaten. The child rolls its head and is manifestly in great pain in the mastoid region and at the base of the brain.

Hepar sulphur will be thought of especially where suppuration threatens; likewise mercurius, which should be prescribed with caution.

Acute Purulent Otitis Media.—This differs from the acute catarrhal form in the greater severity of the inflammation, the presence of a number of pus cells, and in more frequent perforation of the membrana tympani. There is much swelling of the mucous membrane and the discharge may vary in character and in quantity, though usually it is markedly purulent and quite profuse. There is frequently simultaneous inflammation in the mastoid cells. These cases have proved quite obstinate and tedious. They may be caused by cold or an extension from the naso-

pharyngeal cavity through the Eustachian tube to the middle ear. They are also quite common as a complication of scarlet fever, measles and diphtheria, and may follow injuries to the membrana tympani, or proceed from the use of the nasal douche or syringe, or from "sniffing" fluids through the nose. The pain is always aggravated at night and there is more or less fever present until suppuration has taken place. Occasionally, if the case be seen early, the secretion may be drained off through the Eustachian tube, thus preventing perforation of the membrane. The membrana tympani is sometimes perforated in a few hours, but the average time is from two to four days after the inception of the inflammation. When severe pain continues after perforation has occurred it indicates involvement of the periosteum. Suppuration may last only a few days and the perforation promptly heal, or it may continue for several weeks and may even run into the chronic form of purulent otitis. The hearing power is greatly diminished, and usually not restored to the normal for weeks or months. When adhesions form during the healing process, binding down the ossicula to the membrana tympani, permanent damage to hearing is apt to result. In the early stage of the disease, before perforation has occurred, it is impossible to make a positive diagnosis of otitis media. If mucus be present in the discharge from an ear in a given case it is positive evidence of a perforated drum with otitis media, as in external otitis a purulent discharge alone is found. When it is impossible to inspect the entire membrane perforation may be demonstrated by means of the Politzer or Valsalvian method of inflation.

It should be determined early whether there has been involvement of the mastoid. In addition to severe pain, which is always worse at night, the mastoid process is tender on pressure. There may or may not be swelling. The prognosis will depend considerably upon the general health of the patient and whether it is a simple or complicated case. In a healthy patient if the disease is the result of cold or catarrh the prognosis is usually good. It should be guarded in cases occurring in tubercular or syphilitic patients, and in those suffering from diphtheria, scarlet fever or measles, or an epidemic of influenza.

TREATMENT. In all cases the patient should be kept quiet in the house, and when the case is severe should be put to bed. If an adult and the case is seen early the inflammation may be aborted by the application of an artificial leech. It should be applied close to and in front of the tragus. It is very useful when applied over the mastoid later in the disease when involvement of this region is threatened. The pain may be relieved by instilling water into the ear with the dropper, as hot as can be borne. As soon as bulging at any portion of the drum-head is seen the most bulging point is incised. If the secretion is thick it may be necessary to force it through the perforation by Politzer's method of inflation. After paracentesis the discharge should be encouraged by frequent douching with an antiseptic solution, the water being as hot as can be borne. The peroxide of hydrogen instilled in the ear is useful in destroying and removing the purulent material. The application of dry heat, such as hot hop-bags, hot bran, salt and corn meal, or the hot-water bag, will aid in relieving the pain. Various anodyne drops have been recommended, such as atropine and boric acid in solution, or a four per cent. solution of cocaine. A favorite formula in severe cases is

camphorated chloral five parts, oil of sweet almonds ten parts, glycerine thirty parts, to be warmed and instilled into the ear as frequently as necessary. After the inflammation has subsided either the moist or dry form of treatment may be used.

Where there has been very severe inflammation and small perforation in the drum-head results the moist form of treatment is preferable. The application of a saturated solution of boric acid, or syringing with weak bichloride solution, or the application of hydrogen peroxide should be thought of. Where there is a large perforation and the inflammation has not been severe the dry method is perhaps the more satisfactory. This consists in the insufflation of a powder through a powder-blower after the ear has been thoroughly cleansed. Various drugs have been added to boric acid. Hydrastis has proven a valuable addition. When this form of treatment fails to stop the discharge astringent solutions may be used, such as zinc sulphate or cupric sulphate in the strength of about four grains to the ounce. Alumnol, a new antiseptic powder, the base of which is salt of aluminum, is an excellent dry application in purulent otitis. If during the process of acute suppurative otitis media pronounced symptoms of mastoiditis supervene it will be necessary to resort to prompt measures for its relief. The application of alcohol as strong as can be borne is useful in destroying the granulations which sometimes form around the perforation in the drum-head. It will be necessary, even after the perforation is healed, to continue the treatment of Politzer's method of inflation for some weeks to secure the most satisfactory results regarding function.

MEDICATION. The remedies that should be studied in connection with this form of inflammation will include aconite, belladonna, chamomilla, capsicum, dulcamara, gelsemium, hepar sulphur, mercurius, pulsatilla, tellurium, sulphur and psorinum.

CHAPTER VI.

CHRONIC CATARRH OF THE MIDDLE EAR.

Definition.—This is an inflammation of the cavity of the tympanum, characterized by a gradual but progressive change in the structure and character of the mucous membrane and adjacent tissue. These changes are proliferous in nature, producing hypertrophy and hyperplasia as primary conditions, and later on secondary contraction of the new tissue and atrophy. It may be described as a chronic non-suppurative inflammation of the middle ear, accompanied by progressive deafness, tinnitus and vertigo, all of which are accompanied by objective changes in the position, consistency, lustre and color of the membrana tympani.

The causes of the disease may be divided into predisposing and exciting. The predisposing causes of chronic catarrhal otitis are heredity, age and climate, syphilis and tuberculosis. Gouty and rheumatic affections and chronic nephritis undoubtedly predispose to catarrhal otitis.

The exciting causes include, mainly, exposure to sudden changes in temperature, to vitiated air, dietetic excesses, and the intemperate use of alcohol and tobacco, continued exposure to loud noises and heavy concussions. This form of catarrh of the middle ear is often associated with involvement of the internal ear and auditory nerve.

Otitis Media.—Chronic catarrh of the middle ear is very frequently met with, particularly in the changeable, moist climate common to a large portion of the United States. The membrane participates more or less in the inflammation of the tympanum, the usual changes being retraction, thickening and atrophy. Retraction is due to the lack of aëration of the middle ear cavity, owing to the primary hypertrophy of the tissue lining the Eustachian tube and tympanic cavity, thus allowing the effect of external atmospheric pressure to manifest itself upon the drum-head.

It is recognized by the increased prominence of the short process of the malleus, and even of the hammer handle, and obliteration or deflection of the cone of light. Thickening of the membrane is due to the same process of hypertrophy, taking place in the tissues lining the tympanic cavity. It is frequently accompanied by sclerosis and thickening, contraction and rigidity, due to the shrinkage and hardening of the newly-made tissue inside. Atrophy of the membrana tympani is less common, and may be associated with the accumulation of calcareous deposits. The membrana tympani may either be over tense or unduly flaccid. The ossicles or small bones are subjects of pathological changes, their motion being frequently interfered with by the retraction of the drum-head and hypertrophy of the tissues surrounding them. The inflammation often extends to them, affecting the periosteum and articular surfaces and ligaments. Either fibrous or bony ankylosis of the joints and rigidity of the membranes and ligaments surrounding the joints may exist. The tensor tympani muscle is often found contracted, owing to the long standing

retraction of the drum-head. The Eustachian tube will show marked evidences of catarrhal inflammation of the mucous membrane and in the early or hyperplastic stage the tube is frequently much narrower or even quite occluded. Later on, during the hypertrophic stage, it becomes unduly patulous. In the latter stage air inflation, previously indicated, is useless and sometimes even harmful.

SYMPTOMS. The chief symptoms of catarrhal otitis media are deafness, or impairment of hearing, and vertigo. The deafness is of a progressive nature, but varies greatly as regards the rapidity with which it increases in the various cases. With some it sets in early and advances rapidly and in others very slowly, or it may begin later in life and advance rapidly or more slowly until the effects of advancing years accelerate its progress. It is common to find a variation in what may be termed the qualitative and quantitative degrees of deafness. It has been pointed out by Lucae that comparatively good hearing for the watch and accoumeter which is associated with very defective hearing for the voice evidences the existence of a sclerotic process within the drum cavity. Tinnitus is very commonly complained of by patients suffering with chronic catarrhal otitis; in fact, it may constitute the chief or only complaint that the patient has to make. Like the deafness the tendency of tinnitus is to increase in intensity during the progress of the disease and it is most pronounced in the sclerotic stage. It develops great fluctuation in consistency, intensity, pitch and rhythm; in fact, there is hardly a recognized sound of which the counterpart has not at some time or in some case been heard as a subjective noise in the ear. As we frequently find cases where the hearing is improved amid noises as rattling or rumbling vehicles, so, also, cases occur wherein the function is rendered quite indistinct when the patient is surrounded by noises or concussion. Vertigo is not usually a continuous symptom. It comes and goes and is subject to great fluctuation in intensity.

PROGNOSIS. The prognosis of chronic aural catarrh depends upon the age of the patient, the state of general health and the amount of damage already suffered by the ear. In an elderly person, it being likely that the disease is of long standing and that more or less marked tissue changes have occurred, it is, of course, less likely that permanent improvement will be obtained. In cases showing marked deafness with little variation from day to day, or, as the result of treatment and where the symptoms and conditions indicate labyrinthine involvement, a grave prognosis must invariably be made.

TREATMENT. The treatment of chronic catarrhal otitis should be either to remove the cause inducing the pathological condition, or to remove the effects produced thereby. Unfortunately the aural surgeon rarely meets a case of this disease in its earliest stages, the patient presenting himself only after the disease has been present for years, and more or less permanent damage has been done. It is also frequently impossible to insist upon the necessary changes in the surroundings, life and habits of the patient. It is doubtful whether in a true case of chronic aural catarrh a cure in the sense of complete restoration of normal hearing power has ever been accomplished, though sufficient improvement has frequently been obtained to practically answer the same purpose. The patient, however, is quite likely to experience a recurrence of the disease

upon a renewal of the cause, namely, severe acute catarrhal colds, which are frequently neglected and allowed to get well as best they may. The diet in many instances should be regulated, and when excessive or over-stimulating in quantity should be modified. The question of alcoholic beverages and tobacco as causes of catarrh must be considered and if necessary restricted or interdicted. Suitable outdoor exercise should be insisted upon and over-work, worry and excitement should be avoided. Constitutional disease which may be present must receive the appropriate treatment. The local or mechanical treatment will consist of artificial ventilation of the tympanic cavity. This is accomplished by the use of Politzer's bag, or of the Eustachian catheter, by means of which air is forced into the middle ear, increasing the pressure and forcing outward the retracted membrane. In a certain class these procedures are followed by marked improvement; but when actual fixation of the ossicles and drum membrane has occurred inflation of air is of little service; in fact it may do harm by increasing the relaxation of the already degenerated drum-head.

The injection of vapors or liquids into the tympanum through the Eustachian tube, thus directly medicating the lining membrane, has been advocated. The results, however, in my experience have not been satisfactory; in fact I am sure cases have been markedly aggravated by this form of treatment. Electricity has, I believe, been of value in some cases where properly applied. This is especially true in the hypertrophic state of the disease. It should be used with caution, low tension and short sittings being the rule. Paracentesis of the drum-head, tenotomy of the tensor tympani and of the stapedius, and even the radical operation for the removal of the drum-head and ossicles have been recommended in the treatment of this stubborn and annoying disease. Paracentesis acts beneficially mainly by the contraction, through resulting cicatrices, of an abnormally relaxed membrane. Tenotomy of the tensor tympani and stapedius is performed because the supposed rigidity of the ossicles is due to contraction of these muscles. The radical operation of removal of the drum-head and the two larger ossicles, which is recommended and practiced by Sexton, is claimed by him to be the most effective and really curative operation devised for the relief of the deafness occurring with this affection. The author is rather inclined to relegate the operation to that class of cases wherein we may positively declare that hearing power is practically lost and in which any other form of treatment will fail. In these cases harm can scarcely result, and some good may ensue.

In 1887 my attention was called to the application of massage to the membrana tympani and ossicles by means of sound waves. Shortly after this I began repeated experiments in this line of treatment for the deafness accompanying tubal and middle-ear catarrh. Now many skillful otologists in this country are experimenting upon this line, with the result that numerous instruments for the development of vibratory force have been evolved. The theory upon which this method of treatment is based is that of massage, thus producing increased flexibility and, through improved vascularity, better nourishment and development of the diseased tissues. This massage of the hardened tissues has been attempted in a grosser manner by means of spring probes, pneumatic pumps and various

direct mechanical appliances. A method by which massage is accomplished by vibratory force through sound-waves would appear the safer and more natural method of application, and has seemed to be of considerable value in some cases. The best instrument and method of its application are perhaps yet to be devised. This is, however, a potent field for active experimentation.

The local ear treatment must, of course, be accompanied by suitable local and constitutional treatment of the general catarrhal disease. Attention must be paid to the membranes in the naso-pharyngeal space, and the proper homeopathic remedy be administered for the relief of the local and constitutional conditions existing. Remedies that have been found most useful should be applied according to the totality of their symptoms. Those most frequently useful in the hypertrophic form of the disease are calcarea iodide, calcarea phosphorica, gelsemium, ferrum phosphoricum, hydrastis, kali muriaticum, kali iodide, mercurius solubilis, mercurius dulcis, pulsatilla, sanguinaria nitrate, dulcamara, pilocarpine, muriaticum and teucium. For the atrophic or dry form the following should be studied: Graphites, iodine, causticum, kali phosphoricum, magnesia phosphorica, aluminium, phosphorus and silica.

Chronic Purulent Otitis Media.—Chronic purulent otitis media is a chronic suppurative inflammation of the middle ear, and involves primarily the Eustachian tube, tympanic cavity and membrana tympani. Later it affects the upper part of the attic space, and lastly the mastoid, both the antrum and pneumatic cells.

This disease demands prompt and scientific treatment and a radical cure if possible. The hearing is greatly impaired or may be entirely destroyed before the case presents itself.

The usual causes assigned are primarily catarrh and the exanthemata, especially measles and scarlet fever; la grippe of late years has proven a very frequent cause. Phthisical subjects are decidedly predisposed to purulent inflammation in the middle ear, usually free from pain and promptly developing into a chronic condition. This form often resists all treatment. The disease is found in tuberculous, lymphatic, arthritic and syphilitic subjects, and is often associated with naso-pharyngeal catarrh. No case of acute purulent otitis media should be permitted to develop into a chronic form, as under proper treatment acute cases should be entirely relieved, no matter what the cause.

SYMPTOMS. The principal symptoms of this disease are deafness, more or less profound, with the characteristic purulent discharge from the ear, attacks of vertigo and tinnitus aurium. Children usually exhibit a copious discharge. Examination of the ear by means of reflected light and the speculum will reveal the external auditory canal full of muco-pus, with more or less maceration of the skin and perforation or even entire destruction of the drum-head, inflammation of the mucous membrane lining of the drum cavity being visible through the perforation. When there is chronic purulent discharge from the tympanic cavity there must of necessity exist a perforation in the tympanic membrane. This may be at any point of the membrane, less frequently, however, in the upper flaccid portion of Shrapnell's membrane. Usually there is left remaining a rim of tissue, from which, when the discharge is stopped and the process healed, a new drum-head may grow. The com-

monest seat of perforation is in the posterior half of the membrane. The handle of the malleus may remain intact even with great destruction of the membrana tympani; in other instances it may be more or less eroded. Occasionally, if the perforation is large or the membrana tympani is destroyed, the lower portion of the incus, the incudo-stapedial joint and the rami of the stapes, or the niche of the round window, may come into view after cleansing and drying the external canal. A large perforation may exist, and on account of its position, or because of the swelling of the mucous membrane, the ossicles, though present, may be invisible.

TREATMENT. The treatment varies somewhat with the different stages of the disease and the conditions which it may have produced in the ear. The duration should be determined and the mastoid region examined for signs of active or natural mastoid sinuses. The condition of the naso-pharynx and fauces should also be determined, and if diseased treatment must be applied to these parts. In the treatment of this affection antisepsis and asepsis are as essential and important as in the treatment of other suppurative forms of disease. Antisepsis is best secured by syringing the ear with a proper solution, followed by the application of absorbent cotton mops for the purpose of drying the canal. This cleansing should be done by the surgeon alone. A solution of bichloride of mercury, one to three thousand or four thousand, a solution of boric acid, about two and a half per cent., and a weak solution of permanganate of potash are among the most useful antiseptic solutions. If the secretion is thick and difficult to remove, or extremely copious, the instillation of peroxide of hydrogen, fifteen volumes capacity, is of benefit. This drug as now prepared may be slightly warmed without immediate decomposition, thus increasing its value as a medicament for application. Patients or ignorant attendants should never be allowed to use a piston syringe in the ear. Occasionally it may be permitted to an adult patient to carefully syringe the ear by the use of a soft rubber ball syringe, having a pliable soft nozzle (Davidson's No. 6, or Davold's No. 1). After complete cleansing the ear should be carefully examined for granulations or polypi. If these complications do not exist a slender blunt probe should be carefully introduced into the canal; the malleus and inner wall of the tympanic cavity should be examined for spots of caries or necrosis. If the latter condition exists all caustic treatment is contra-indicated. The extremely thin osseous wall that separates the tympanum from the facial canal renders it easy for the occurrence of perforation, producing an implication of the facial nerve either by extension of inflammation or by pressure. The ear should be cleansed frequently, depending upon the nature and quantity of the discharge and the rapidity of its formation. Offensiveness may soon be overcome if antisepsis is continued. After cleansing a solution of pyoktanin, yellow or blue, or a solution of mercuric bichloride or simple wine spirits may be applied.

Usually the best method is the insufflation of impalpable powdered boric acid, boric acid calendulated, boric acid and iodoform, aristol or hydrastinated boric acid, after thoroughly cleansing and carefully drying. There should be only sufficient powder to cover the fundus and diseased parts. This dry form of treatment is efficacious and should be carried out daily for a short time, and then every second or third day, extending

the intervals as the discharge decreases. When the affection is complicated by actual caries or necrosis of some parts of the bony structure the treatment with surgical solvent applications should be tried. This will consist first of careful cleansing of the ear cavities with an antiseptic solution, followed by the application of the selected solvent, which consists of a digestive ferment, as glycerinum pepticum. This is prepared as follows: a half-ounce of water is heated to about 115 F.; with this is mixed one-half drachm of glycerinum pepticum and two drops of hydrochloric acid c. p., (eight drops dilute acid U. S. P.) The ear is filled with this mixture and it is allowed to remain half an hour, when the liquid should be thick and black. The ear is then carefully syringed, dried, and the cavity insufflated with boric acid. In a few days the process is repeated. When there is no existing necrosis this method of treatment is useless. If this treatment fails to benefit the patient within six weeks or two months, and if the membrane of the drum cavity is granulating and drainage is defective, or if there is a carious process existing in any of the bones, operative measures should be resorted to. The membrana tympani, malleus and incus may require excision.

Granulations and polypi are quite common complications of chronic purulent inflammation of the middle ear. Aural polypi vary in size from a millimeter to three or four centimeters in length. The large ones block the entire canal and even extend beyond the meatus. They are often multiple and may arise from the mucous membrane or muco-periosteal lining of any portion of the tympanum. Occasionally they spring from the membrana tympani or the skin of the external auditory canal.

At times these polypi produce reflex phenomena, such as hemiplegia, epileptiform convulsions, sudden or acute paralysis of the facial nerve, tendency to faint and muscular weakness. These symptoms disappear promptly upon the removal of the polypus. Granulations will disappear usually under careful antiseptic treatment, especially when applied in the dry form by means of powders, or by the instillation of alcohol. Should they persist they may be touched with chromic acid, applying the deliquesced crystals upon the end of a probe.

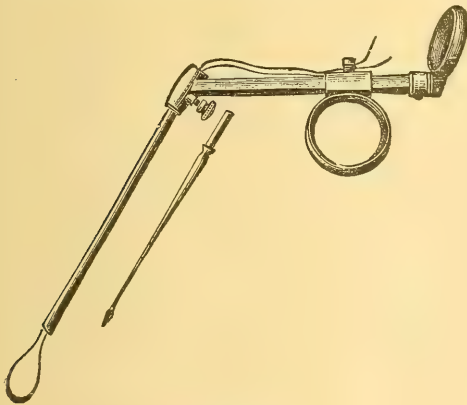


Fig. 1063.
Blake's Snare.

Polypoid hypertrophy of the mucous membrane of the middle ear with protrusion through the perforation, resembling true polypus, should never be cauterized nor snared off. It will disappear under insufflation of antiseptic powders. In true pedunculated polypus the first step should be the removal of the growth, thus relieving the ear of irritation, perfecting the drainage of discharges from the middle ear, and expediting the application of remedies. After the removal the pe-

dicle stump or foot must be destroyed to prevent reappearance. After instilling a five or ten per cent. solution of cocaine into the ear to

produce anesthesia the surgeon proceeds with the removal. The best method is that with the polypus snare. (Fig. 1063). The best form of wire for use in this delicate snare is that known as brass saddler's wire which is used in harness-making. It is fine but flexible and sufficiently strong to constrict the pedicle of an aural polypus. Occasionally small polypi may be removed with a hook made for the purpose. Hooks are somewhat dangerous. They are apt to catch in the walls of the canal and inflict painful wounds. The polypus should first be examined carefully with a probe to determine the position of its pedicle. A loop is then formed in the wire of the snare, somewhat larger than the growth, and its plane is turned toward the polypus that it may readily be slipped over it. When fully engaged gentle traction on the trigger of the instrument will constrict the pedicle and the polypus will be readily removed. Some hemorrhage follows the removal; this, however, is usually very slight. It is readily stopped by hot water injections. When this has been accomplished search should be made for the former attachment of the polypus, and when found it may be cauterized with chromic acid, as already described. A powder of boric acid and iodoform, seven parts to one, should be dusted in the canal, the ear dressed and the patient discharged for twenty-four hours, at the end of which time if the powder in the ear is still dry it should be left undisturbed another day. If the discharge reappears antiseptic syringing must again be resorted to, followed by thorough drying and possibly by another application of chromic acid to the base of the pedicle. The remedies most frequently of use in this tedious affection are *calcareo carbonica* and *calcareo phosphorica*, *capsicum*, *kali muriaticum*, *cinchona*, *elaps*, *hydrastis*, *hepar sulphur*, *mercurius*, *kali bichromicum*, *kali iodatum*, *tellurium*, *thuja*, *pulsatilla*, *sulphur*, *psorinum* and *silicia*.

Excision of the Membrana and Ossicles.—

Excision of the membrana and ossicles may prove necessary in the event of the failure to cure the disease by the methods already described; and even though it may not beneficially affect the hearing it will frequently prevent extension of purulency or necrosis to the antrum, the mastoid region and vital parts beyond. When this operation is to be done the patient must be anesthetized, both to prevent suffering and to secure quiescence. Bright sunlight, if obtainable, is the best source of illumination, but this being uncertain it is far better to depend on the electric forehead lamp. The instruments recommended for the operation are the angular knife for transfixing the membrana, a blunt-pointed knife for puncturing the latter, an angular knife—both for right and left sides—for disarticulating the incus from the stapes, a bent probe to pull the bones into view when necessary, a foreign body forcep (Fig. 1064), delicate in shank, for removing the ossicles, and a number of cotton-holders, previously armed with cotton. A syringe and hot water should be at hand to check bleeding. The membrana being first transfixed just behind the short process of the malleus, is then divided all around the periphery



Fig. 1064.
Foreign Body
Forcep.

at the back, by the blunt-pointed knife, afterward repeating this operation anteriorly. If the incus-stapes joint is visible the surgeon should try to disarticulate the incus from the stapes, removing the former. This is accomplished with the hook knife attached to a straight and slender shaft; it should be passed between the handle of the malleus and the descending ramus of the incus, and a small hooked blade thrown over the joint by a turn of the handle between the thumb and finger; a gentle downward pressure will sever the joint and the incus can be withdrawn through the perforation by traction with the knife. The further removal of the incus is accomplished with the foreign body forceps. If the joint is not exposed the round-pointed knife should be inserted close behind the processus brevis and the posterior superior quadrant of the drum-head incised, that the joint may, if possible, be exposed. If it can be discovered it should be secured and the incus removed as above described. If not discovered the curved tenotome should be passed behind the short process of the malleus and the tendon of the tensor tympani cut. When the incus has been destroyed during the progress of the disease the round-pointed knife should be swept about the periphery and the malleus handle or any remnant thereof should be seized by the forceps and removed. The ossicles under these conditions are more or less carious. After the removal the ear is cleansed, powdered iodoform or iodoform and boric acid is insufflated and the patient is allowed to rest for twenty-four hours.

When the suppurative process is confined to the attic space there is perforation of Shrapnell's membrane, with a scanty, offensive discharge adherent to the upper wall of the auditory canal. This perforation may occur in different portions of the membrana flaccida. It may appear directly above the short process of the malleus or in the posterior segment, in which case there is usually great discharge and accompanying mastoid symptoms. These cases are quite obstinate and accompanied by profound deafness. Occasionally there is complete destruction of the membrana flaccida, bringing into view the neck and head of the malleus and the junction of the latter with the incus, together with a portion of the crura of the incus. There are several methods of treating this form of purulent inflammation. Cure may be accomplished by the injection of antiseptic solutions through the perforation direct, by the introduction of powders through the perforation, or by excision of the membrana tympani, including the malleus and incus. This latter is frequently the only means of cure. Much relief and occasionally a cure has been accomplished by the injection of antiseptic solutions by means of the tympanic syringe. Probably the best form is that designed by Blake. (Fig. 1055). To this is fitted slender nozzles nine centimeters long with diameters varying from one-half to one and a half millimeters. This syringe is filled with peroxide of hydrogen. The delicate nozzle under perfect illumination is introduced through the perforation. Then, during careful inspection the contents are slowly and gently forced into the attic. This is followed by the characteristic reaction. This is not painful, though occasionally accompanied by more or less dizziness. Other applications may be made with this syringe of the same nature as those applied in purulent disease of the tympanic cavity. If the perforation be large enough boric acid or other antiseptic powders may be insufflated through the perforation. This, however, has not proved a very satisfactory procedure. It seems

to be the general experience of surgeons that excision rarely fails to stop suppuration or greatly diminish it. It furthermore promptly checks a tendency toward mastoid inflammation and necrosis with pyemia and cerebral abscess. Hearing, if any exists, is usually improved after excision. Vertigo, headache, tinnitus and the occurrence of frequent "gatherings," so common in the otorrhea of children, are promptly relieved by this operation.

Sequelæ.—The sequelæ of chronic otitis media are various and may be described as follows: First, cholesteatoma of the middle ear and temporal bone; second, caries of the temporal bone and portions of the adjacent bones; third, cerebral abscess; fourth, sinus thrombosis, pyemia and embolism in organs other than the brain; fifth, malignant diseases of the ear.

CHOLESTEATOMA of the middle ear and the petrous bone may be primary, but usually follows chronic suppuration in the middle ear. This disease is commonly known as pearly tumor, and consists of a mass of densely-packed epithelial cells undergoing fatty degeneration and mingled with numerous cells of cholesterine. This mass produces ulceration of the muco-periosteal membrane, granular formations, erosion of the bone and invasion of the deeper parts of the cranium. The discharge from the ear is highly offensive and vertigo is often complained of by the patient. Inspection reveals a whitish or pale yellow, cheesy mass lying in the canal of the middle ear. As parts of it are removed granulations bleed easily and the ear is extremely sensitive to touch. In many instances this mass may be syringed from the ear by means of warm water. If too dense it must be softened by instillations of hydrogen dioxide, or a mixture of bicarbonate of soda, twenty grains, glycerine, two drachms and water, six fluid drachms. This should be instilled and permitted to lie in the ear for some time before syringing. By this means, combined with patient picking with the probe or curette, all of the mass contained in the canal and drum cavity may be dislodged. That extending to the mastoid cells can be reached and removed only by a mastoid perforation: the removal of these masses must be followed by continued antiseptic applications and careful treatment by means of antiseptic powders.

CEREBRAL ABSCESS. Ear disease is the commonest cause of cerebral abscess, the symptoms of which are frequently vague for a considerable time. They are latent and may include headache, vomiting, a dull mental condition accompanied by restlessness or lethargy, irritability, convulsions, earache and slow cerebration. This latter is considered to be the most characteristic symptom. The commonest situation is in the temporo-sphenoidal lobe of the cerebrum and is usually situated very close to the roof of the tympanum. The spread of the infection is invariably due to imperfect drainage of the middle ear.

SIMPLE CEREBRAL ABSCESS. This form is accompanied by slow pulse of even rhythm and good volume. Meningitis produces a rapid pulse of small volume which is irregular. Emaciation, where there is not high fever nor diarrhea, is often characteristic of the cerebral abscess when accompanied by intense fetor of the breath.

TREATMENT. The treatment will consist in an endeavor to improve drainage of the ear by gouging or trephining the mastoid sufficiently to

open the horizontal cells of the antrum, where pus is frequently found, and to break a hole through the deeper part of the posterior wall of the external meatus, so as to prevent the retention of the secretion. The cavity should be made aseptic as soon as possible. It may be necessary to expose the posterior surface of the petrous bone to allow free drainage, and this is best accomplished at a point one-half an inch above the anterior margin of the external meatus. This condition usually necessitates the offices of the general surgeon, and will be more fully treated of elsewhere.

PHLEBITIS. Accompanying chronic purulent otitis media there may be marked phlebitis. In the great majority of cases this produces death from pulmonary pyemia. It is accompanied by marked erratic pyrexia and rigors. Prompt action is necessary, as death usually occurs within three weeks of the inception. Earache, vomiting, coma, listlessness, vertigo, convulsions and occasionally diarrhea, emaciation and acute nephritis are symptoms of this condition. Well marked optic neuritis may be present. The usual form of treatment is to ligate the jugular vein in the neck and lay open the lateral sinus. If the clot be found to be foul and septic it should be scraped out and the cavity rendered aseptic as soon as possible.

Occasionally it is well to ligate the jugular vein low down and seal it, and then again above the vein, dividing between the ligations and bringing the upper end out so that septic matter may escape externally. This, of course, is a last resort.

MENINGITIS. Meningitis is the most fatal complication occurring in children under ten years of age; and the younger the patient the more likelihood there is of the occurrence of meningitis. It is usually secondary to some other complication. The attack is sudden and the course rapid; the temperature is elevated; there is usually headache, though not so severe as in cerebral abscess; earache frequently occurs, and patients are drowsy and drift into coma. Vomiting and restlessness are frequently seen. The optic disks are ordinarily found to be normal, convulsions and twitchings of the limbs with hemiplegia and paresis of the arms, ptosis, facial paralysis and strabismus have also been seen. Surgical interference when meningitis has been thoroughly developed can be of little use, though in the early stage the lesions which produce it are capable of treatment by free drainage, which may occasionally be successful.

CHAPTER VII.

ACUTE AND CHRONIC MASTOIDITIS.

Importance.—Inflammation of the mastoid portion of the temporal bone demands most serious consideration from the aural surgeon. The structure of this portion of the temporal bone and its relationship to the middle and external ear and other immediately neighboring cavities explain the manner in which it may become a channel for the transmission and reception of morbid processes originating in the neighboring cavities. The most frequent and most important diseases of the mastoid from a surgical point of view are those that are secondary to similar processes in the middle ear. It is extremely rare to find primary inflammation of the mastoid, and when present it is usually the result of injury or of exposure to extreme cold. It is also comparatively rare to find cases of mastoid invasion from the external auditory canal consequent upon an external otitis, either diffuse or circumscribed. When this occurs and there is produced a superficial circumscribed periostitis, resulting in death of the adjacent bone and the contiguous cell walls, the inflamed region is usually isolated and the sequestrum or mass of separated bone is either spontaneously extruded or removed by surgical procedure; this reveals a limited cavity, promptly filling in with granulation tissue.

Secondary Inflammation of the Mastoid.—This is the form of mastoiditis most commonly met with and is an inflammatory process secondary to disease of the middle ear, being transmitted usually through the channel of the mastoid antrum. The pain appears suddenly and unexpectedly, radiates from the middle ear forward and upward and, later, backward toward the mastoid region, and is usually continuous, though it frequently is of a paroxysmal nature. It is important that we recognize early the conditions indicating inflammation of the upper portion of the tympanic cavity, which in many cases will provoke quite serious consequences. We should also be prompt with treatment, either internal or, if necessary, surgical interference to forestall the effort of nature to effect depletion of the area and afford relief. The preventive measures which should be promptly applied and are of most service consist of incision through the membrana tympani in its most prominent part, supplementing this by dividing the horizontal folds in the posterior-superior quadrant of the tympanum toward the antrum; cold applications over the mastoid surface, and local depletion by means of the artificial leech, or by cupping, combined with internal medication and hygienic measures.

In the operation of puncture or of division of the horizontal folds there should be perfect illumination of the field of operation, with absolute cleanliness thereof. Therefore the external auditory canal should be cleansed of all accumulations, such as cerumen or scales of epidermis, by means of syringing or mopping with a solution of corrosive sublimate (1 to 5000) or of carbolic acid (1 to 15 or 20); in fact all of the usual preparations should be made for a perfectly antiseptic operation. The

speculum and other instruments, consisting of a paracentesis needle, a narrow-bladed curved knife, and a thin double-edged, spatula-shaped knife, curved upon the flat, should be sterilized by immersion in antiseptic solution, by boiling or by passing through an alcohol flame, and just before using them they should be dipped in a saturated solution of boric acid in alcohol. This, in addition to providing cleanliness, makes the blade of the instrument more clearly visible, owing to the deposit upon it of the white powdered boric acid left remaining after the evaporation of the alcohol. The patient, if a child, should be firmly held, and full control of the head, arms, body and legs should be obtained. The instrument, whether the knife or needle, should be sharp, owing to the fact that the drum-head yields readily under pressure and a dull-pointed instrument may be productive of undue violence. When from the severity of the general symptoms it seems advisable to divide the posterior horizontal folds into the antrum the first incision in the drum-head should be made in the superior posterior quadrant, from a point posterior to the short process of the malleus, following the curve of the periphery under the posterior fold to a point midway between the centre of the peripheral border of the posterior segment and the starting point. The spatula knife, having a blade about six millimeters long and one millimeter wide, should be passed through this opening upward and backward to the ascending process of the incus into the antrum and swept forward, and again backward in its withdrawal. Bleeding and serous exudation are to be encouraged, and the pain controlled by dry warm applications. The ear should be dressed in a thoroughly antiseptic manner, and this should consist of the introduction of drainage-tufts of dry absorbent cotton, large enough to fill the canal lightly, this being thoroughly aseptic and handled with sterilized fingers. These tufts should be carried into the ear until the patient flinches slightly, and then withdrawn a little. The outer ear should be covered with a pad of cotton, and this external dressing should be replaced whenever it becomes moistened with serum, and the whole dressing removed at proper intervals, to be determined by the freedom of the discharge. Providing sufficient relief is not secured by the procedure just described, or in relation with this treatment if necessary, direct depletion or the application of cold may be used to affect the mastoid circulation. The application of leeches or of the artificial leech is a useful measure of depletion. Wilde's incision, consisting of a cut over the mastoid, through the soft tissues and periosteum to the bone, posterior and parallel to the auricle, is often of much value and all-sufficient as a surgical measure.

TREATMENT. General treatment will include rest, freedom from noise and excitement, a light non-stimulating diet and internal medication. A most important abortive measure is the application of continuous cold to the mastoid region, by means of compresses or Leiter's coil.

Indicated homeopathic remedies in acute or chronic mastoiditis will include belladonna, gelsemium, ferrum phosphoricum, and capsicum annuum (particularly beneficial where middle ear inflammation exhibits a tendency toward mastoid involvement), hepar sulphur, calcarea carbonica, calcarea fluorica, silicia and hecla lava.

OPERATIVE TREATMENT. Opening the mastoid process, in the majority of cases, is for the purpose of liberating pus and removing the contents of this septic cavity. It should properly be accomplished under such perfect antiseptic precautions as are now common to all surgery. The ear should be syringed, the parts about the mastoid should be shaved and the entire surface carefully scrubbed with soap and water, and just preceding the operation the head should be washed with an antiseptic solution. The hairy portion of the head should be covered with a rubber cap, or with thick layers of clean, aseptic towels. The head and shoulder should be slightly raised and in proper position to permit of free access to the regions requiring incision. The neck and shoulders should be covered with rubber sheeting or with towels wrung from antiseptic solution. The instruments which may be required consist of scalpels (Figs. 1065 and 1066), one having a slender narrow blade, and a half dozen artery forceps, two broad curved retractors, one narrow retractor with a hooked end, large-sized Bowman probes, a curved explorer, a fine steel probe, several sizes of hand drills (Fig. 1067), large, medium, and small sharp spoons and gouge-shaped chisels. Complications may ensue in mastoid disease consisting either of extension of the inflammation toward the brain cavity, or outward and downward into the soft tissues of the neck. This will require the surgeon to be prepared to proceed further than



Fig. 1065.
Poltzer's
Mastoid
Scalpel.



Fig. 1066.
Burnett's
Mastoid
Knife.

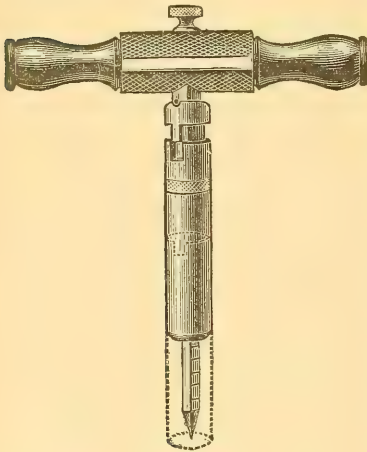


Fig. 1067.
Wilson's Mastoid Drill.

the simple mastoid operation, and, should circumstances require it, to open the cranial cavity to secure exit of pus and free drainage, the lateral sinuses for the removal of thrombus, or the cervical triangle of the neck, with ligation of the necessary vessels.

The instruments having been previously sterilized by boiling in a solution of bicarbonate of soda, should be placed in shallow trays or upon a surgically clean towel on the table, and should be grouped advantageously according to their requirement in the different stages of the operation. Boiling water should be provided in an irrigator and is used for flushing the wound during the operation, and douching it after its completion. The hands of the surgeon and the assistants should be sur-

gically clean and portions of the bed or table with which they or the instruments are apt to come in contact should be covered with antiseptic towels. The incision, as a rule, should extend from a point opposite the superior border of the auricle downward to the mastoid tip, and following

the curve of the insertion of the concha. Hemorrhage from the incision should be controlled by means of artery forceps and hot water sponging or by the use of the broad, smooth retractors, these serving also to expose the bone quite freely, thus allowing of a careful inspection by means of the explorer and fine probes, to discover, if possible, any small sinuses.

The first opening into the bone may be made with the smallest drill and increased in size by the use of the larger drills and then by means of the gouge and chisel, chiselling with a small light mallet. Within the cavity of the mastoid the operation should be continued as far as possible by means of sharp spoons alone, thus curetting until the diseased bone and tissue are entirely removed. Sometimes it is necessary to remove a portion of the inner wall, or of the entire mastoid. The spoons are un-fenestrated in design and provided with a stout shank and a bowl with sharp-cutting edges. The gouges should be in two sizes, the larger being for use on the outer wall of the mastoid, otherwise on hard bone, and the smaller in the deeper structures. When the operation is concluded and the membrana tympani is found perforated or has been incised, the wound and the ear should both be thoroughly syringed with warm boiled water, or bichloride solution, this being done to secure a passage through the antrum. The ear should then be carefully dried and plugged with pledgets of sterilized gauze. Antiseptic gauze dressings should next be applied over the mastoid region of the ear. It is not usually necessary to insert drainage tubes or gauze into the wound, nor need stitches be used. Twenty-four hours after the operation, unless previously necessary, the wound may be opened and explored with a probe and syringed with a weak bichloride, or, preferably, a permanganate solution. The wound is allowed to close in from the bottom as rapidly as possible, preserving an external opening, permitting free drainage and the use of the curette, should any small particles of bone be detached subsequent to the operation and discovered during the later probing and dressing. The course of the operation within the cavity of the mastoid should ordinarily be inward and forward at the upper angle to reach the mastoid antrum. This may vary and should be governed by the exigencies of the occasion. The operation may be varied by the entrance of the mastoid from the posterior wall or the external auditory canal, the auricle being detached and reflected forward for the purpose. The complications of mastoid disease may require more extensive operative measures and it may be necessary to make an opening into the cranial cavity, either from the mastoid cavity upward and forward anteriorly to the ridge of the petrous process, or posteriorly through the wall of the sinus, or directly into the cranial cavity through the squamous process above the auditory canal. In the former instance, it being a continuation of the mastoid operation, the primary opening may be enlarged forward or backward by means of the chisel and cutting forceps. In the latter instance when operating above the external canal the trephine may be used in one or two places and the opening enlarged or united by means of the bone forceps, being careful to avoid breaking or wounding the dura mater, which may be examined for evidences of inflammation or suppuration. If the extradural region is not the source of the affection, the dura should then be opened. When the pus from the mastoid cavity burrows into the tissue of the neck it makes its way downward along the line of the sterno-

cleido-mastoid muscle, sometimes passing forward into the anterior triangle, but usually extending from the digastric fossa backward under the deep fascia and down the back of the neck.

When swelling is discovered over the digastric fossa, with tenderness upon deep pressure and evidences of inflammation of the mastoid tip, the incision along the mastoid should be carried downward and backward posteriorly to the insertion point of the sterno-cleido-mastoid muscle, proceeding as far down the neck as may be required to secure drainage.

The precautions necessary to be observed in performing any form of mastoid operation, except the simple opening of the mastoid, are to avoid interference with the facial nerve where it passes through the base of the petrous bone and along the posterior tympanic wall below the antrum, and injury of the sound-transmitting structures of the middle and external ear.

SECTION XXXV.
MODERN SURGICAL TECHNIQUE.

CHAPTER I.
PREPARATORY STEPS.

General Considerations.—It is impossible to understand the changes in surgical methods which have taken place in the last twenty-five years, and which are still continuing to develop, without comprehending the dependency of present day surgery upon the principles of asepsis and antisepsis. The revolution which has brought us to the perfected methods of to-day began about 1867 with Lister's announcement of his system. Since then there has been a constant change of such a character that the use of the term "modern" is entirely appropriate in speaking of the technique of the day. Further than this, by reason of the remarkable advances in the extent and character of the operations now undertaken.

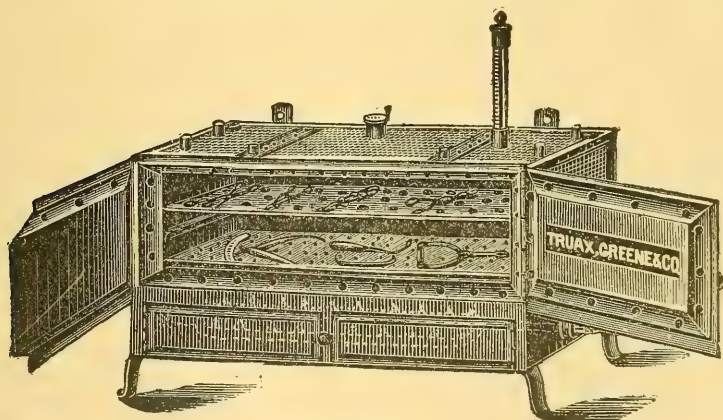


Fig. 1068.
Hirschberg's Hot Air Sterilizer.

new details have developed, many of which have received an almost universal acceptance, while others have been found faulty or have been superseded by those having a better application.

While all surgeons recognize certain principles underlying modern methods each one carries them out according to his individual conception, and develops thereby a system of personal procedure. The sum of all these details, this step-by-step work, is the operator's technique. Any operation, capital or minor, is made up of a succession of single steps

following so rapidly upon each other, and so overlapping and blending, that sometimes it is difficult to define them in sequence. To accomplish this the surgeon must be familiar with all the alternatives of each step, thus being able to rapidly make choice of the special one having the best applicability in each instance.

First of all sepsis and asepsis must be thoroughly understood, and everything be done according to their principles. The aim is and ever

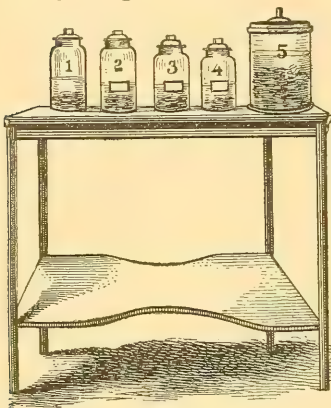


Fig. 1069.
Aseptic Solution Table.

should be to accomplish everything according to asepsis, yet recognizing that certain factors may be present which render this impossible. Where possible, however, aseptic conditions should always be established. Bacteriologists have proven that an ideal asepsis in operating is an impossibility, but operators have proven, in turn, that practical asepsis is entirely feasible. The surgeon should,

therefore, thoroughly acquaint himself with the practical methods and, having done so, understand that most rigid adherence to them is an absolute necessity. There is no latitude for personal interpretation of these principles, if by latitude is meant laxity in carrying them out. The same quality of exceeding care must be exercised by all who are concerned in the operation.

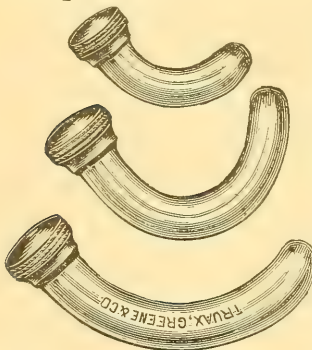


Fig. 1071.
Berlin Needle Bottles.

First of all the operator must be most punctilious in thoroughly developing every step of the detail of preparation. A careful plan of work should be outlined, comprehensive enough to include the majority of operations, and all assistants should be thoroughly grounded in every minutia.

There is no question that better and safer work can be accomplished in hospitals than in private practice. In the former the assistants and nurses live in an atmosphere which prompts to strict observance of every detail. One is a check upon another by noticing any lack of attention; discipline is easily established and maintained, and there is less possibility of the introduction of uncontrollable factors. The ranks of the assistants are also easily kept filled by advancing them from one class of work to another, with which

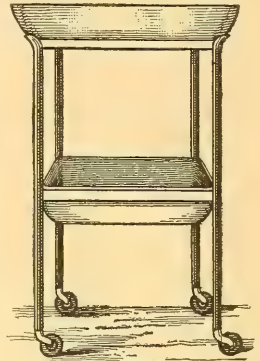


Fig. 1070.
Reception Stand.

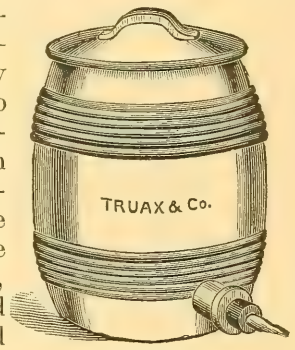


Fig. 1072.
Porcelain Irrigation Jar.

they are not wholly uninformed by reason of their previous associations. In private practice the inconsistencies of an aseptic technique are sometimes remarkable in spite of the most watchful care of the operator, and that unfortunate results do not oftener occur is cause for gratitude rather than a reason for relaxing our attention.

The beginner can do no better than to formulate some rule of procedure based upon the opportunities he has had for observation of that which

has been proven a sound method, then follow this rigidly and with an almost mathematical precision until his experience is such that he is warranted in instituting changes. In doing this he has a basis for comparison and can then depart from and vary it with increasing knowledge. No insignificant factor of any technique is an accurate knowledge of the

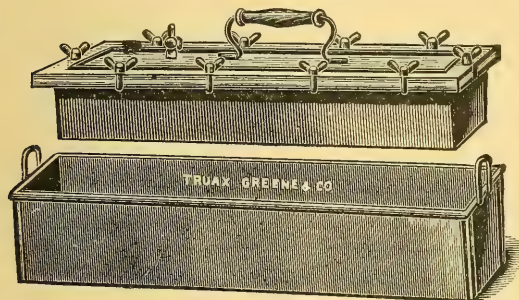


Fig. 1073.

Portable Steam Sterilizer.

anatomy of the parts concerned. Having such knowledge, hemorrhage becomes merely a "bugaboo" for one who knows when and where to expect it. A technique which compensates for a poor anatomical knowledge is therefore faulty. As an illustration—seven or eight ligatures on either side of the uterus during an hysterectomy, either vaginal or abdominal, is not clever work, for usually two on each side will suffice. It is a faulty carrying out of technical detail due to ignorance of anatomy, and to the really skilled operator tells its own story. Simplicity in pursuing details should be the aim, and to this end a good working knowledge of anatomy is essential.

Preparation for an Operation.

—No less needful to the proper conduct of an operation is the preparation therefor. This is very important, frequently requiring a long time to complete it, and should be intrusted only to those who are skillful and reliable. When possible all preparation should precede the hour of operating and nothing avoidable should be left until the patient is on the operating table. Each step of preparation should be carried out adequately, with plenty of time and as having a recognized place in a well-matured plan. Assistants should be taught that no detail can be slighted, and that the success of the whole depends upon the conscientious observance of each part. All should be taught to master details, while no one should be more punctilious in the observance of them than the operator himself, since any carelessness on his part would be sure to infect some of his assistants.

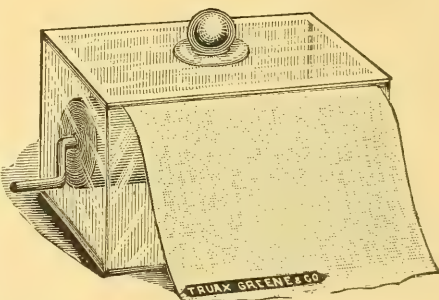


Fig. 1074.

Glass Iodoform-Gauze Case.

PREPARATION OF THE SURGEON. The operator should always be prepared. By that it is meant that his life should be such that he is physically fit at any hour, and it should be so ordered that he can prepare himself at a few moments notice. This forbids the performance of autopsies and certain kinds of pathological work.

FIRST ASSISTANT. Where a surgeon is operating constantly he should have a skillful assistant who alone participates in the actual manipulation at an operation. Such an assistant should be advanced enough to comprehend the importance of his position and be thoroughly familiar with the principles governing his work. Since the profession at large has accepted the statement that by far the greater part of all infection is transmitted through the hands at the time of operation the surgeon

should be as sure of his assistant as he is of himself. Few younger men fully realize all that it means to be a good first assistant. Above all else, after carefulness of preparation, he should be willing and able to identify himself with the operator, to look ahead and judge what is coming, see in his own mind the various steps of the operation

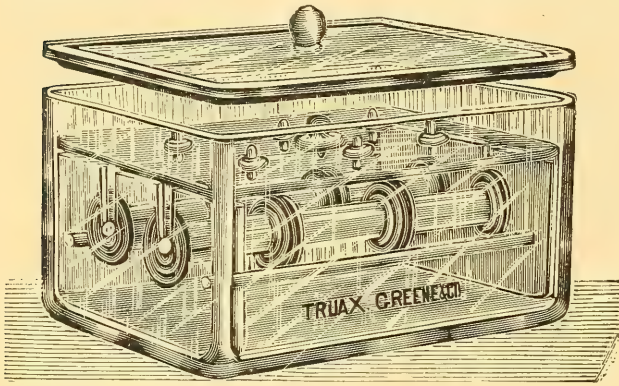


Fig. 1075.
Glass Ligature Box; Hospital Size.

before they are actually reached, quietly make suggestions to other assistants with a view to having everything ready when needed, and thus put and keep himself thoroughly in sympathy with the operator. Nothing is in poorer taste nor more annoying to some sensitive operators, than to have an assistant who affects superiority, who perfunctorily does what he must do, carrying, moreover, a little mental protest with each act, and conveying the impression to the operator or others that there are better ways of doing the particular thing in hand. No two men do the same thing in the same way, and no matter how much an assistant differs in his opinion with the operator he should remember that probably much time and thought have been expended in formulating the plan which it is now his opportunity and duty to promote.

NURSES. For service in an operating room only nurses of experience should be chosen who have already been trained for this work and have had instruction in the principles of asepsis. It should always be remembered that if a septic condition results from an operation which should have been conducted aseptically the fault lies in the system of technique.

The nurses are usually in regulation dress. The operator and

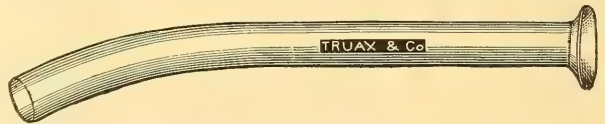


Fig. 1076.
Glass Drainage Tube.

assistants should remove all outer clothing, put on clean white duck trousers and a large cotton or linen apron open at the back with sleeves coming barely to the elbows, to which points the arms should be bared.

PREPARATION OF THE HANDS. The hands of all, nurses included, should be washed and scrubbed with a brush in soap and hot water, the water being changed several times. Special care should be bestowed upon the interstices under and about the nails, and if the exposed skin is anywhere broken it should be covered with cotton saturated with colloidion. After such a washing the hands and arms should be faithfully scrubbed in bichloride of mercury, 1 to 1,000, then dried on a sterilized towel, and again scrubbed for a moment in absolute alcohol, after which they should be immersed in a hot solution, 1 to 1,000, of bichloride of mercury and remain long enough to allow the mercury to penetrate into all parts of the hands, especially about the nails; it should then be washed off in hot sterilized water or a normal salt solution. Or, after thoroughly scrubbing the hands and arms in soap and water they may be soaked in a saturated solution of permanganate of potash for about three minutes, after which a warm saturated solution of oxalic acid is employed until the stain of the permanganate is removed. They are then freely washed in sterilized water until the oxalic acid is removed, then laved in bichloride of mercury 1 to 1,000, and the sterilized salt solution is again employed, after which the operation may begin.

This preparation of the hands is one of the most important steps in

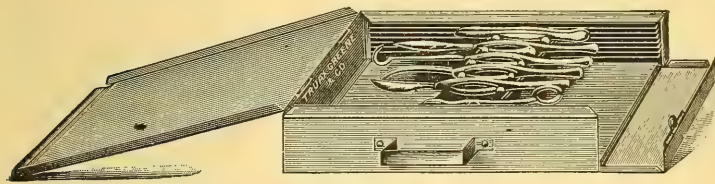


Fig. 1077.

Small Sterilizing Instrument Case

any system of asepsis, since it is universally acknowledged that infection during operation is more likely to take

place through the hands of the manipulators than by all other known methods. During the operation there should be constantly ready a deep vessel with sterilized water or salt solution or bichloride of mercury, 1 to 2,000, in which the operator and his first assistant should frequently bathe their hands. This removes all blood and serum from the hands and keeps them in proper condition. During the operation should the hands come in contact with pus, feces, urine or any substance which would soil them they should be carefully prepared anew before continuing the operation. Each step has a specific purpose and should be conscientiously carried out. Spectators who are to be in the immediate vicinity of the operation should lay aside the coat and put on a long apron similar to those worn by the operators, opening at the back but having long sleeves snugly buttoned at the wrist; but under no circumstances should they participate in the operation without previous preparation.

ASSISTANTS. Everyone present at an operation occupies a position which carries certain duties with it. Of course the operator is most dependent upon the first assistant, and happy is he who has in such an *aide* one who identifies himself with his chief. All those who are immediately concerned in the performance of the operation should be diligent in

attending to those things entrusted to them. The assistant with instruments should attend to the instruments and to nothing else, running ahead in his preparations so as to anticipate the approaching want. He should also be faithful to asepsis, for if he be careless disaster may result. No one, apart from the operator, is in a position to so prolong an operation as is



Fig. 1078.
Drainage Tube.

the assistant with the instruments. He can and often does waste many minutes because not ready with certain things when wanted. If the operator must wait for every suture to be selected and threaded or every ligature to be cut something more than one's temper goes to waste.

Anesthetizer. The anesthetizer is the most important assistant of all in many ways. Having one who can and will take all care of the anesthetic, the operator may do the rest with almost any kind of assistants, although of course at the sacrifice of time. He to whom is entrusted the anesthetic should pay no attention to anything else and should give prompt warning of any dangerous signs. If he be careful the minimum of the anesthetic will be used, and the patient will never be allowed to be in danger from that source. If the operation itself is severe, as shock is developed he will be sparing of the anesthetic and will recognize the difference between danger from chloroform or ether, and the danger of shock and its accompaniments. He will not over-use the hypodermatic syringe by giving injection after injection of brandy or some other drug, but will carefully stimulate to get the best of whatever is used, recognizing that a reaction may follow and prove fatal. He will bring his patient to the end of the operation ready to regain consciousness and in no danger through any carelessness of his. No one is more deserving of a grateful respect than such an anesthetizer who consistently maintains an even course through a long and trying operation. Nothing is more cheering when matters are not going smoothly and every fibre is alert with insistent doing to have an inquiring glance at the anesthetizer elicit a prompt and pleasant nod or low-toned answer that all is well there. And such a really competent anesthetizer is the hardest assistant of all to obtain.

Minor Assistants. All minor assistants should be faithful to their allotted duties, as more may depend upon the punctilious discharge of these than the assistants realize. They should handle nothing not connected with the operation and should confine themselves each to his particular assignment. Whoever cares for the sponges has a very important place so far as danger of introducing sepsis is concerned. The sponges are intrusted to him alone, out of the sight of the operator, and then are returned to the immediate wound; he should carefully count them before the operation, and again after it, and be sure they are all accounted for. It is not pleasing to spend half an hour searching the abdominal cavity for a sponge and, not finding it, have to wait two or three days to be sure it has not been left in the

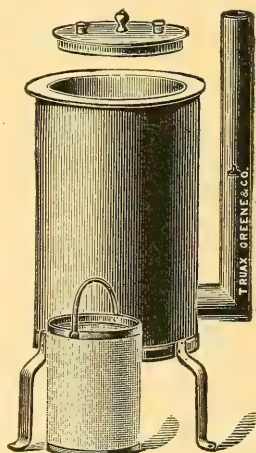


Fig. 1079.
Pasteur's Hot Air Sterilizer for Dressings.

abdomen, all because the heedless assistant has made a miscount. It is far less pleasing, needless to add, to sew up the abdomen and leave one within, as has happened many times.

To the patient himself one's duties are never so imperative as when he is passive and helpless under the operator's hand, and every one present should keenly recognize all such obligations. Care should be taken not to allow anything done which would not be done were the patient conscious. Keeping this in mind, unnecessary exposure will be avoided; in this particular we are all likely to be careless. No rough handling should be allowed. If lay friends of the patient are present at the operation a watchful eye should be kept on them, and if they faint or become hysterical they must be gently cared for.

SPECTATORS. All who are present as spectators should remember where they are, and that an operating room is not the place to exchange the gossip of the day. The courtesy of silence is certainly due to the operator, who is too often annoyed during a long and tedious operation by the irrelevant comments of those about him.

CHAPTER II.

OPERATING ROOM AND INSTRUMENTS.

Private Operating Room.—If an operation is in a private house the cleanest room, most convenient as to light, should be selected, by preference one having a northerly exposure. The extent of preparation of such a room depends somewhat upon the character of the operation and the time and assistance at one's disposal. If a minor operation is contemplated careful attention to those things coming immediately in contact with the patient will usually suffice to insure good results. If a more serious case, such as an abdominal section, is in hand greater care should be exercised, and if time permits the room should be thoroughly overlooked. All draperies, hangings and ornaments should be removed and everything remaining cleansed. The walls, if painted, may be washed; if papered, carefully brushed and rubbed down with bread crumbs. The floor, if wood or covered with straw matting, should be washed; if carpeted it should have clean linen or sheets stretched over it. A bed, one or two tables, according to size, and two chairs are all that is necessary for furnishings. The operator or a competent assistant should supervise the preparation of all the instruments and accessories. The same care should be employed as in a hospital, and instruments, dressings and materials of all kinds should be sterilized. There should be an abundance of boiled water or, better still, of salt solution, and such antiseptic solutions as the case requires.

Hospital Operating Room.—A room designed especially for operations—and such are found in hospitals, public and private—should be used for no other purposes. It should be without closets, well-lighted, having both lateral and

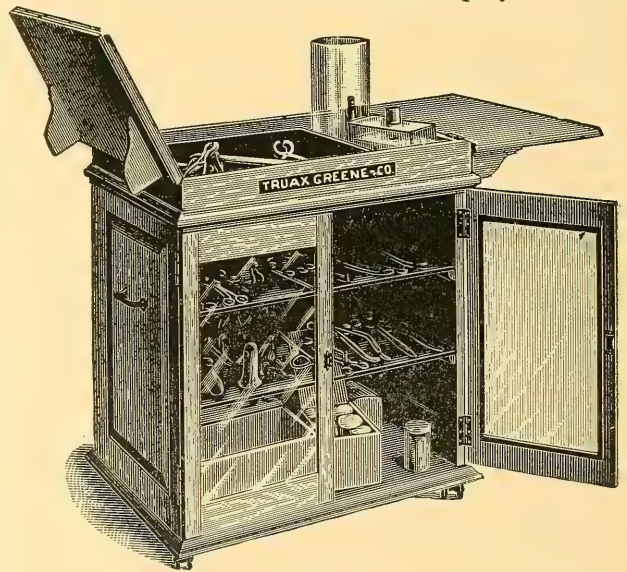


Fig. 1080.
Pratt's Instrument Cabinet.

overhead access from a Northern or Northwestern exposure, and so placed that it cannot be overlooked from without. The walls and ceilings should be painted and varnished, giving them a smooth surface and one quite as desirable as when lined with glass or marble. The walls

should be plain, without ornamentation, and with as few angles and interstices as possible. The floor should be of hard pine closely laid, covered with linoleum—or, that which is perhaps better, sheet rubber three-eighths of an inch thick—which is sealed together where the seams join. If this covers the floor within three inches of the edges it is more easily kept clean than when it overlaps and extends several inches up on the walls, as is sometimes advised. The disadvantages of the latter method are that joints that are difficult to manipulate are formed at each corner of the room, while it is not easy to turn up the edges to properly clean under them. If the covering does not occupy all the floor space each side can be turned in upon itself and the free margins of the floor and rubber be properly washed and thoroughly cleaned as required. In addition, if a moulding be fitted, occluding the angles between floor and walls, cleanliness is much facilitated.

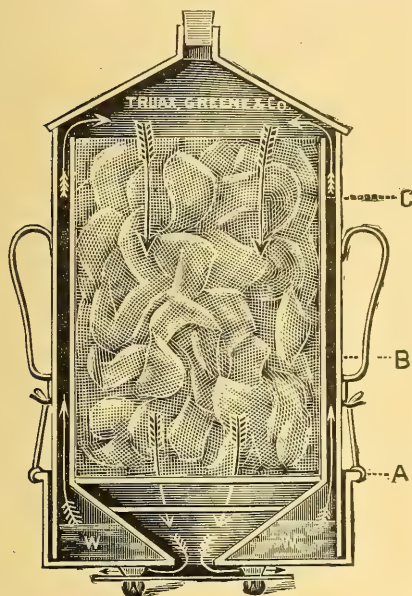


Fig. 1081.
Buckman's Steam Sterilizer.

Floors of asphalt or cement with a drain should be entirely condemned; they may be kept clean so far as the drain outlet, but from that point further control is impossible. A regurgitation of drain gas from such an orifice is surely not a desirable probability. When arranging the heating it is a simple matter to provide a steam jet from the pipe, so disposed that the room can be filled with steam at will, thus saturating the atmosphere and depositing all dust. There should be hot and cold water with one well-trapped sink. All plumbing should be as simple as possible and exposed. Above the sink on a shelf should stand jars, varying in capacity from two to five gallons, one containing a solution of bichloride of mercury, 1 to 1,000, one sterilized water or normal salt solution, and one a five per cent. solution of carbolic acid. These should communicate with the sink below by taps or rubber tubing fitted with a stop-cock. A good method of arranging such jars is to have them bottle-shaped with necks above, the latter stopped with plugs of sterilized gauze or cotton tied in place by a piece of sterilized gauze; or the necks may be closed with tightly fitting rubber stoppers through which pass medium-sized glass tubes bent like a syphon. The outer arm of the tube should be filled with sterilized gauze, and as the opening is downward no dust settles upon the orifice leading to the jar. Of these jars those

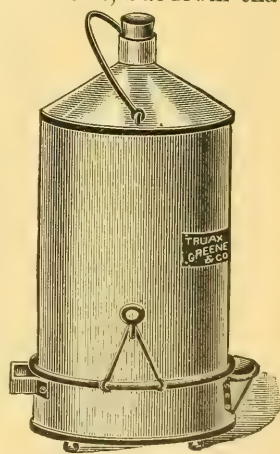


Fig. 1082.
Portable Sterilizer.

designed for sterile solutions, should be filled with strict attention each time to the sterilization. They are as easily cared for and protect their contents as efficiently as any reservoir and from them the various fluids can be drawn in any needed quantity and diluted as desired. For such dilution

a graduated glass should be used, never trusting to any one's judgment by the eye alone to prepare a dilution of fixed proportions in an open vessel.

Furnishings of Operating Room.—The furnishings of the room should be those of necessity alone and exceedingly simple:

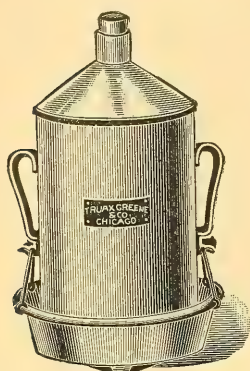


Fig. 1083.
Water Sterilizer.

An operating table; two instrument tables; instrument cases; two stools; one steam sterilizer; a jacket kettle; one dry sterilizer; one irrigator for sterilized water or salt solution; agate ware trays for instruments; agate ware wash basins; one agate ware slop jar; one collecting reservoir for operating table (these latter may be made of enameled metal, porcelain, or glass); two or three pitchers or graduated glass jars with thermometer attached; nail-brushes and jars for same, containing 1 to 1,000 mercuric solution; glass jar for sterilized sponges of two sizes; glass jar for sterilized gauze sponges; glass jar for natural sponges in solution; one glass shelf for basins with solutions; one two-shelf iron and glass table for instruments; one two-shelf iron and glass table for instruments, gauze, sponges, towels, cotton, body bandages, T bandages, one- or two-tailed roller bandages; one jar with various sized drainage tubes in solution; one jar with various sized solid tubes in solution; trays for instruments; sheep-gut of various sizes in receptacles; silk-worm sutures in receptacles; silk in receptacles; silver wire in tubes; lead plates and perforated shot in receptacles.

The date of sterilization should be on everything.

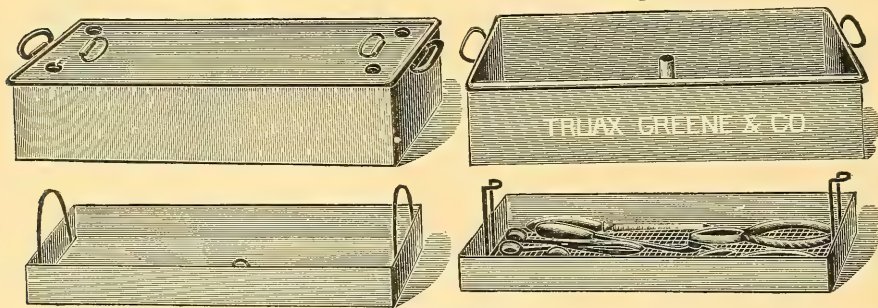


Fig. 1084.
Surgical Instrument Sterilizer.

There should also be at hand (a) brandy, (b) strychnia, (c) digitalis, (d) glonoine, (e) camphor in sweet oil, thirty to seventy, (f) ammonia, (g) per- or sub-sulphate of iron, and (h) a hypodermatic syringe.

Temperature.—The temperature of the operating room is very important, and here, as in so many other details, opinions are at variance. Some advise a temperature as low as sixty-eight degrees Fahr. This does not seem reasonable, because the temperature during anesthesia is sub-normal. When all the circumstances of a capital operation are taken

into consideration it would seem as if a higher temperature, as high as eighty degrees, were more rational, and in prolonged abdominal sections where the viscera are more or less exposed a temperature as high as ninety degrees is an aid to minimizing shock. Often one of the most difficult problems confronting the surgeon is to how to quickly get up a

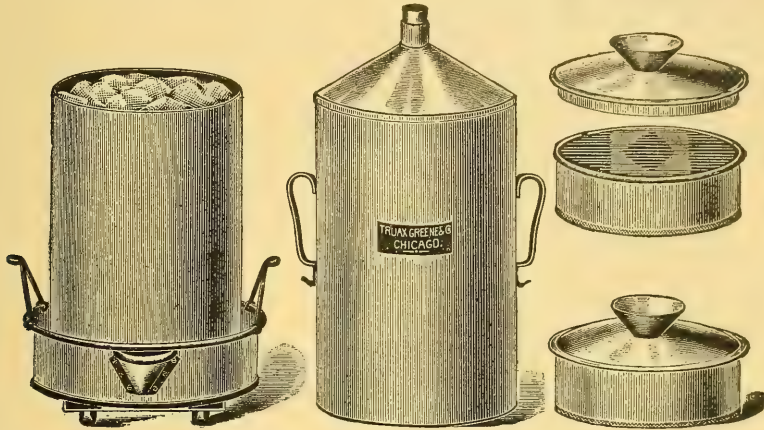


Fig. 1085.
Sheep-gut Sterilizer.

reaction in a given case, and first in the means of accomplishing this is heat freely supplied all about the body. If this is maintained during an operation as well as supplied after it the results are beneficial to the patient.

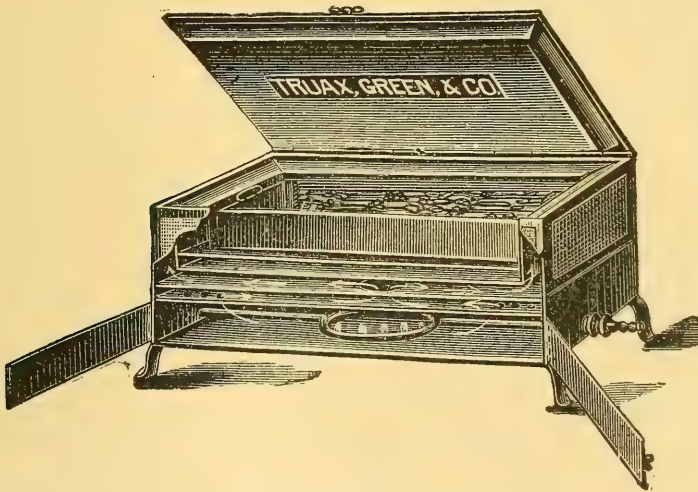


Fig. 1086.
Lasar's Copper Hot Air Sterilizer.

Post-Operative Room.—Whether in private or hospital practice, after an operation the patient should be removed to a specially prepared room. The furnishings of this room should be as simple as compatible with comfort. It should have a Southerly or Westerly exposure, thereby insuring the benefits of the sun. The walls should be plain, painted and varnished, the floor of hard wood closely laid, with a hard

wood finish throughout if possible; if not, then the wood should be painted and varnished. A high iron bedstead with a woven wire spring and hair mattress should be so placed that the light falls from the head or side,

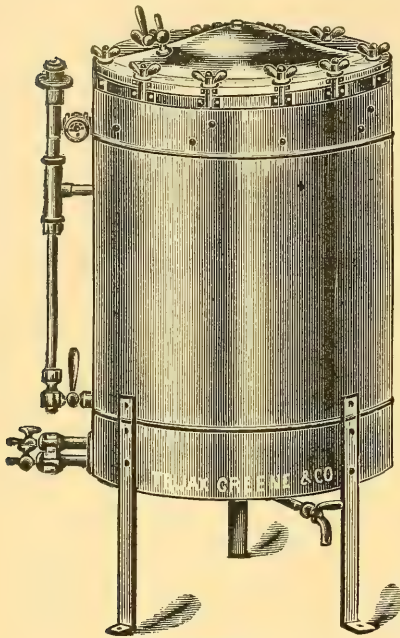


Fig. 1087.
Schimmelbusch's Sterilizer.

not directly into the face. In capital cases it is well to have two such beds of the same height, as it is a simple thing to slip the patient from one bed to the other, and a very restful change withal. If not a second bed a plain and comfortable lounge should be accessible at such time of convalescence as the patient can leave the bed. One or two ordinary chairs, with or without foot-rest and movable back, suffice. The window should be so arranged that it can be curtained at any time to afford a grateful light, and a folding screen is always useful. Such a room should have no set bowls or plumbing of any kind, but should have a clothes-closet and also an open fire-place.

Instruments.—The instruments for any given operation should be selected in advance and carefully sterilized a short time before the operation. In case of several operations in succession each one should have its own set of sterilized

instruments previously prepared, or else they should be sterilized after each operation. It is not necessary to enumerate instruments. Each operator develops peculiarities about the instruments he uses, and rarely becomes dependent upon any special selection. All instruments should be made with reference to ease of sterilization, and to this end should be as simple as possible. They should contain few parts and these should be arranged in such a way that they can be readily separated and cleaned. The locks should be simple and strong, and all parts made of metal. Knives should have solid metal handles with blades of good steel, and it is better to have them over- than under-tempered. They should be kept sharp by applying them to a good oil stone, and in whetting them the blade must be kept flat to the stone with

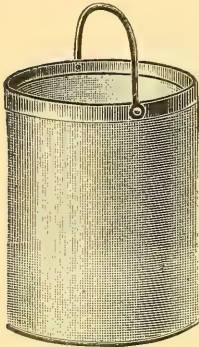


Fig. 1088.
Gauze Bucket.—
Schimmelbusch.

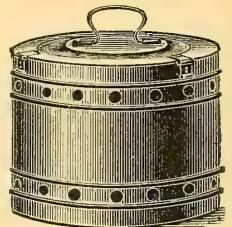


Fig. 1089.
Ventilated Dressing
Basket.—
Schimmelbusch.

an even pressure from heel to edge of the blade. Frequent sterilization by heat tends to cause them to lose their temper and become soft, after which a keen edge is impossible. All instruments must be sterilized before each operation and this is best done by boiling for fifteen minutes in a one per cent. soda solution. After each operation the separate parts

of each instrument should be washed in soap and water and scrubbed with a brush, the sterilization to precede the operation. The parts of instruments which are alike in construction, like artery forceps for instance, should be numbered so that they can be readily fitted after cleansing.

Few instruments are necessary for any given operation, and they should always be enumerated by the assistant who has them in charge both before and after the operation, lest some of them escape notice and become lost in one of the cavities of the body.

CHAPTER III.

PREPARATION OF THE PATIENT.

Previous Preparation.—The preparation of the patient should begin as long before the time appointed for the operation—depending upon the character and severity of what is undertaken—as is demanded for the proper carrying out of every precaution. In abdominal cases forty-eight hours are none too much time for the completion of essential preparations, while minor cases may safely wait until the hour of operating.

Asepticism.—Taking an abdominal case as a type of all capital operations, the patient, if able to undergo it, should have a vaginal douche and full hot bath not later than the second evening before the appointed day. If there has been constipation an enema should be given and the results noted. The next evening the douche, the enema and the hot bath are repeated; the nurse intrusted with this duty should be able to judge whether or no the bowels have been sufficiently evacuated. The abdomen should then be thoroughly washed with soap and water, scrubbed with a brush, lathered and shaved, again washed and scrubbed with soap and water, all to the end of effectually getting rid of the dead and superficial epithelium, fine hairs and general surface detritus. The soap should then be washed away with sterilized water, the field of operation thoroughly laved with bichloride of mercury, 1 to 1,000, and the parts dried with a sterilized towel. Then ether or absolute alcohol should be poured over the surface and allowed to evaporate, for the purpose of removing the oily secretion of the skin, after which the parts should again be freely flushed with bichloride of mercury, 1 to 1,000, and covered with gauze or absorbent cotton, previously sterilized or wrung out in a 1 to 1,000 solution of bichloride of mercury. This should be inclosed with sterilized gauze and cotton confined by a bandage exactly as after the operation. The vagina should be especially prepared, when necessary, by following the hot water douche with one of hot bichloride of mercury, 1 to 2,000, and then packing with sterilized plain or iodoform-gauze. If a capital operation is to be undertaken wherein the vagina is involved it may be necessary to repeat this process the morning of the operation, the packing to be left until such time as the operator shall direct its removal.

These dressings should be left in place until the patient is on the operating table, when they should be carefully removed by a nurse, the clothing of the patient having first been arranged as follows: The lower extremities should be inclosed in leglets—loosely fitting and made of old flannel which has become thick by shrinking—which extend to the hips; the night-dress should be folded upward and so disposed as to gently confine the patient's arms; then the field of operation should be surrounded by rubber sheets or mackintosh, also made surgically clean by previous washing in bichloride of mercury, 1 to 500; the bandages and dressings which have been in place over night are next removed by a nurse, when

the protectives are carefully covered in by sterilized towels so arranged that nothing in the immediate vicinity of the working area can possibly come in contact with anything which has not been already rendered aseptic; before placing the towels the parts may be flushed with a 1 to 1,000 bichloride of mercury solution, or wiped off with a towel gently wrung out from such a solution, although this precaution ought not to be necessary.

These directions are applicable to any operation, modified according to the parts concerned.

During the preparatory days the diet should be simple but nourishing and adequate, and no solid food should be given for at least six hours before the operation. On the morning of the operation a breakfast of some meat-tea or broth should be allowed, since this, even if undigested, will cause no coagulum or solid particle in the stomach to give trouble subsequently in case vomiting should occur.

Care of Patient.—Before important operations the patient should be put into as satisfactory a condition as is possible, and if the indications for interference are not urgent time is eventually gained by waiting for such a purpose. If, for example, the patient is exhausted by severe hemorrhage, the hemorrhage should be controlled and its effects offset by careful, generous diet and proper medication. If this is not possible, it is well to remember that interference is intended to bring relief and the diseased condition having been removed, recuperation may be very rapid.

The secretions should be intelligently observed and the condition of the heart, kidneys, lungs and skin carefully noted, not only with a view to the choice of anesthetics, but also to assist in forming an estimate of what the patient can wisely undergo. The bowels should be thoroughly evacuated, and this is especially necessary before any abdominal operation.

CARE DURING OPERATION. During an operation the quality of respiration and pulse should be carefully noted, not only on account of their relation to the anesthetic, but as indicating the status of the patient. This is especially needful if there is great loss of blood. If the latter comes in a sudden rush, a large quantity being poured forth in a limited time, stimulants should be resorted to, and none are better at such times than hypodermatic injections of brandy, or camphor and sweet oil, together with subcutaneous injections of a normal salt solution in considerable quantity, a pint or a pint and a half of the latter being quickly absorbed. Loss of bodily heat should be avoided so far as possible by surrounding the patient with warm blankets; the application of sheets wrung from water as hot as can be borne and placed over the chest and heart gives excellent results in tiding over a crisis. The operation should be completed with reasonable dispatch and with the gentlest manipulation possible under existing circumstances.

POST-OPERATIVE CARE. After the operation the patient should be removed to a bed well-warmed, wrapped in blankets rather than sheets, surrounded with hot-water bottles so carefully protected that the patient cannot be burned by them, and an attendant should keep him under constant observation, noting especially the character of the pulse and respiration. Care should also be taken that no complications arise from vomiting as the patient recovers consciousness, the head being kept con-

stantly to one side and the vomited matter removed from the mouth and pharynx if not entirely expelled. Judicious stimulation is in order, always remembering that if alcoholic stimulants are carried to excess a stage of reaction follows in which the depression may be too profound for recovery. If the respiration is slow and sighing, with a feeble heart action, camphor is a better stimulant than brandy or whisky, but if the heart seems to be the most affected, with a very weak, thready and irregular pulse, the hypodermatic injection of one-fiftieth to one-hundredth of a grain of strychnia gives excellent results. Glonoine may also be administered in such conditions. So soon as the stomach will tolerate anything hot water is best given in small quantities, and the thirst is much more satisfied if it is put into a glass and drunk rather than sipped from a spoon. Ice is not of benefit at such times, since it increases rather than alleviates the troublesome dryness of the mouth. A smooth button or stone, or a rolled bit of old linen given to the patient to hold in the mouth sometimes affords a welcome palliation of this excessive buccal dryness and hastens and promotes a flow of saliva. Within a few hours water gruels and simple liquid preparations may be offered. Abdominal cases give the most trouble at first by reason of the great thirst, the intolerance of the stomach and the severe intestinal pain. Manipulation of the intestines during an operation always causes more or less tympanites, which the author believes has a distinct function in causing a normal reposition of the intestines. The accumulated gas pushes on through the bowel, straightening out twisted and rotated intestinal loops until the lower bowel is reached, when escape takes place, almost always affording marked relief. This can be frequently anticipated by passing a rectal tube to the sigmoid flexure, or giving an enema of simple hot water. As soon as gas freely escapes from the rectum relief from the abdominal pain usually follows at once, and if the further course of convalescence is favorable severe intestinal pain is not again experienced. The bladder must be watched at first and if needful the catheter must be used. After abdominal cases if there is intraperitoneal suturing in the vicinity of the bladder, as after hysterectomy, too much distension of the bladder must not be allowed, as it might possibly cause some of the sutures to cut out. The amount of urine should be noted for the first two or three days, especially if there has been manipulation in the vicinity of the ureters. The quantity is diminished during the first day or two by reason of the loss of blood, the restricted diet and the actual lack of fluids in the whole body, but close observation quickly tells if there be any serious deficiency.

Contrary to the quite generally accepted ideas about the necessity for a movement of the bowels on the second or third day after an operation, it is entirely safe and frequently conducive to the comfort of the patient to allow seven or eight days to elapse before any attempt is made to bring about an evacuation, if all is going well. Before operating, the bowels are empty; after the operation very simple foods are given, and those which have the smallest residuum of waste; the diet is also so restricted that all nutritious constituents of the food are stripped out of it; the result is that the first discharge on the sixth or seventh day requires assistance, either by means of a hot water enema or one of pure glycerine and sweet oil in equal parts, which relieves the lower bowel. While the action may be sluggish for some days following, little difficulty is thereafter experienced in procuring adequate relief.

CHAPTER IV.

SUTURES.

Suture Materials.—The requirements of a suture are such that comparatively few substances have been found from which we can make a selection. Whatever is used must be put into such form that it will be fine and smooth yet strong enough to withstand the strain which may be put upon it and soft and pliable enough to readily follow the needle and adapt itself to the parts in which it is to lie. It must be in condition to be readily tied in a knot or otherwise securely fastened, easily removed either by mechanical means or absorption, and it must be non-irritating. Bearing these qualities in mind, and remembering that they are not theoretical only but that practically the sutures used must conform to them closely, the surgeon finds himself somewhat restricted in choice of materials. Almost everything possible has been tried, but only a limited number of materials are in favor today.

Silk.—Silk thread has always rightly held the most favored position as a suture. Apart from its inability to be readily absorbed and the ease with which it becomes secondarily affected, it has all the necessary qualities to a degree almost ideal. The shortcomings of other materials by contrast emphasize the desirability of silk.

Animal Sutures.—The principal recommendation of this class of sutures is its capability for absorption. With the introduction of the antiseptic methods of Lister, an absorbable suture became a necessity, and he popularized the so-called “cat-gut”—really sheep-gut, and so-called in this volume—which, although in previous use, had failed to win the recognition it has since received.

SHEEP-GUT. Although believed to be sometimes made from the gut of a cat, from which it received its name, this suture is usually made from the intestine of the domestic sheep. The best of this material comes from Italy and Southern France. Italian gut is considered the best in the world. The material as we find it commercially is made of the submucous coat of the intestine, and if not too carefully stripped, but still allowed to include some of the muscular fibres, its resisting powers are supposed to be heightened. As a suture it is readily absorbed, but is more troublesome to tie and is not so manageable as silk; exact coaptation with it is more difficult to secure, it is much more troublesome to prepare, and if not properly prepared is very dangerous, and it may be absorbed too quickly, before it has fulfilled its requirement of coaptation. This last difficulty can be overcome, however, by chromicizing. Many other animal materials have been used and variously advocated, such as

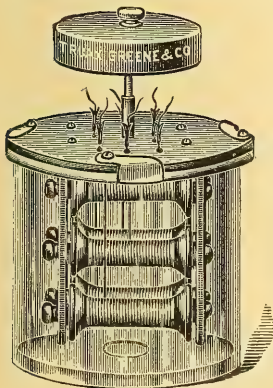


Fig. 1090.
Vienna Ligature Bottle.

the tendon of the caribou, strands from the tail of the rat, kangaroo tendon, and other substances of a like nature, but all possess the common disadvantage of animal origin and difficulty in sterilization, although if properly prepared the practical results from their use are very nearly identical. The so-called "cat-gut" is always at hand, being a common article of commerce, is accurately classified into sizes, is of adequate length and is comparatively inexpensive.

SILK-WORM SUTURE. This is a most excellent material where its use is allowable. It is polished, smooth, strong, transparent, absolutely unchangeable and non-irritating in the tissues, and while not absorbable, neither does it absorb anything and so become independently infectious. It may remain indefinitely and if used as a buried suture be put in place and left with assurance that it will cause no trouble. It is also very easily removed, and it is sufficiently pliable to come away readily, no pain being caused thereby. On the other hand, it is stiff and somewhat difficult to tie, and is not adapted to very fine work.

Metal Sutures.—Many kinds of metal sutures have been tried, but silver is the best. It is the typical wire suture. It is particularly smooth and pliable, readily fastened so as to secure the utmost accuracy of coaptation and perfect regulation of tension, and furnishes support and immobilization as no other suture can. One of its best qualifications is the manner in which it splints and fixes an area of soft tissues with a minimum of irritation. It may be left indefinitely, and it has even been claimed that it antagonizes the action of the staphylococcus epidermic albus, and consequently is not so liable to favor a stitch abscess. It is used largely as a deep suture for regulating tension, and is indispensable for the suturing of bone. The principal objections to it are that it is not adapted to fine work and is not readily removed, its removal causing more pain and irritation than that of any other suture.

Primary Sutures.—These are sutures which are inserted and tied in place at the time of operation.

Secondary Sutures.—Secondary sutures are those which are put in place at the time of operating but are not secured, being left to close some space purposely allowed to remain open, but afterwards tied at varying intervals of time, e. g., twenty-four or forty-eight hours.

Another General Classification.—This divides most sutures into three classes—superficial, or sutures of coaptation, intermediate, or sutures of approximation, and deep, or sutures of relaxation (Fig. 1091). The first are merely skin sutures irrespective of the special kind, designed to secure an accurate coaptation of the cut edges of the wound. Those of the second class are

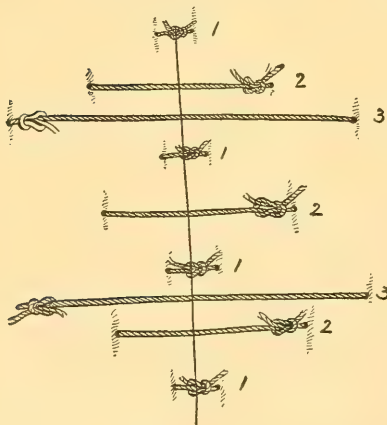


Fig. 1091.
1—Superficial Sutures.
2—Intermediate Sutures.
3—Deep Sutures.

deeper than those of the first, and are intended to obliterate dead spaces in the depths of the wound and to approximate the cut surfaces beneath

the integument. The third class, consisting of the true sutures of relaxation, are passed deeply into the tissues and at some distance from the wound and are intended to take the tension from the included wound area, thus fixing otherwise mobile tissues. They support and bear the weight of large flaps, and no matter what tension may be put upon the parts—as, for example, in the strain upon the abdominal wall after an abdominal section, caused by the vomiting induced by the anesthesia—they resist this instead of the recently united wound, which, thus immobilized, more quickly heals. For this purpose nothing is better than silver wire.

APPLICATION. The application of these forms of suture is very simple, having in mind the purpose of each kind. The distance from the edges of the wound varies according to the depth of the suture. In superficial sutures they are inserted something less than one-eighth of an inch from the wound margin, while from six or eight to the inch are used. Intermediate sutures should be inserted as far from the margin of the wound as is the depth to which they will descend, and the number will be according to the support needed. Deep sutures are put in according to requirements. If a thick abdominal wall is to be secured they should be passed as far from the edge of the wound as the thickness of the abdomen. In flaps after a breast extirpation they must go through the whole thickness of the base of the flaps.

The line of passage should be the arc of a circle having a radius as long as the distance from the wound edge to the point of insertion, this being a safe general rule to guide in the placing of sutures. Special care

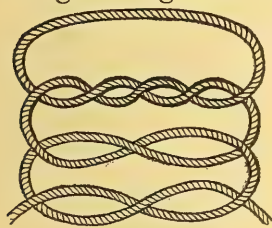


Fig. 1092.
Surgeon's knot with added
knot for sheep-gut.

must be taken that the edges do not incurve, bringing skin surface in apposition with raw wound surface; for wounds never heal when so placed and are likely to cause an unsightly cicatrix. The various sutures above mentioned may all be used at one time, in which case they are inserted in the order of their depth from the surface, deep, intermediate and superficial. They may be tied as they are placed, or all inserted first and then tied in whatever order the exigencies of the case may demand. The knot employed should be a square one, or the so-called surgeon's knot, and should lie to one or the other side of the wound-line, never immediately upon it. It should be tied in such a way as to fulfill all the requirements of perfect apposition, but not to strangulate or excite the tissues. Unless care be taken when the sutures are secured inflammation, with cutting of the skin, will result and easily favor suppuration, the so-called stitch abscess being frequently caused in this fashion.

In the use of deep sutures especial care must be exercised in the manner of securing them, as if they are tied in the ordinary manner they often must be made so tense in order to serve the desired purpose that they actually injure the inclosed tissues. In closing an abdominal wound, for instance, the deep sutures of silk passing entirely through the wall must be tied so tightly that a partial strangulation results; again, there is not the accurate apposition of the various planes of tissue which results when the different layers are secured one to the other by silver wire but-

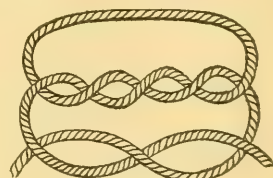


Fig. 1093.
Surgeon's Knot.

ton sutures. These latter must be secured with care. One end of the silver wire is passed through a perforated shot, then folded back upon itself and inserted into the shot, leaving a small loop protruding from it, after which the shot is crushed. This serves the double purpose of preventing the slipping of the shot from the wire, while at the same time no sharp end of the wire is left to catch in the dressings. A shot simply crushed upon a piece of wire will not stand much strain without slipping off. A perforated lead plate from three-quarters of an inch to one inch in diameter is then threaded upon the wire down to the fastened shot; a sufficient number should be prepared in this way before the operation. As these sutures are placed another perforated plate and shot are passed upon the free end of the wire, and these ends are held by an artery forcep until ready to be secured, thus preventing the loss of either shot or plate. After all other sutures are in place, the relaxing sutures are held in one hand, drawn until fixed, and then with forceps each bullet is in turn grasped and pressed upon its plate until just the right tension is reached, when it is crushed upon the wire. The free end of the latter is then wound once or twice around beneath its own shot to prevent slipping, and all the ends are cut off as closely as is possible.

These sutures are removed at intervals varying from three to twelve days, the time being somewhat dependent upon the purposes subserved by the suture in each special case. To remove it the suture should be grasped near its exit from the skin, firmly drawn out from the parts which conceal it, and with a pair of curved scissors, which press the underlying soft parts as deeply as possible, it is cut off and withdrawn. In this way, and by reason of the elasticity of the confined tissues, the cut end retracts deeply into the passage in which the suture lies, leaving less of it to withdraw than if it is carelessly cut as it lies on the surface. Moreover, nothing is carried into the deep tissues nor are they injured by the dragging through of the exposed rough end, which may be infectious. As the suture is withdrawn the underlying parts should be steadied by counter-pressure. In removing silver wire the blades of the scissors which exert the counter-pressure should be applied in such a way that

the wire is drawn over them instead of the skin. In extensive wounds it is not always best to remove all the sutures at once. A part of them may be left and withdrawn a day or two later. After removal the parts should be supported by adhesive plaster applied in whatever manner most effectually prevents any strain upon the wound, but not in contact with the wound.

A more special classification of sutures divides them into the following forms:

Interrupted Sutures.—This is the typical suture and includes all deep, intermediate and many superficial sutures. Except when used as a skin suture it is inserted by means of a curved needle passed through the opposite lips of the wound in a symmetrical manner up-

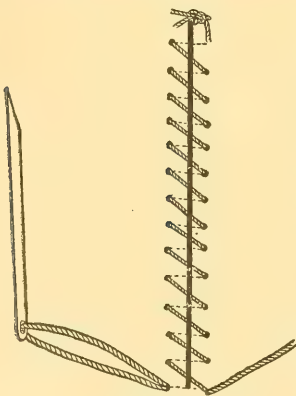


Fig. 1094.
Continuous Suture.

on both sides, each one being independent of all others. When silk is used it is almost always applied as an interrupted suture.

Continuous Sutures.—The continuous suture or "Glover's Stitch"

or "over and over" stitch has equal applicability as a superficial and as a buried suture. (Fig. 1094). As the former it is a suture of coaptation and takes the place of the interrupted suture for this purpose because of its simplicity, rapidity of application, even apposition, increased support, better cicatrix and the need of few knots to secure it—no insignificant recommendations. Absorbable sutures used for skin apposition are almost always of this form.

They may be applied in two ways, giving practically the same result by either method. First, the needle is passed beneath the skin at one angle of the wound and tied in exactly the same manner as for an interrupted suture; instead of cutting the ends short, however, the needle is again inserted at a point about one-sixth of an inch from its previous entrance and about one-eighth of an inch from the wound margin, carried through the skin and out upon the opposite side of the wound, the needle having been used at a right angle to the long axis of the wound. The exposed portion of the suture when drawn into position lies at an angle of forty-five degrees across the incision, while the buried portion is at right angles to it. This process is repeated, each stitch being equi-distant from its fellows and all applied in such a way that the four adjacent stitch-holes form the angles of a square or rectangle, divided into two triangles by the exposed part of each suture. A suture applied in this manner causes accurate coaptation, the buried part supporting the skin from below, the exposed part supporting it from above, and both together acting as so many splints. When the last stitch is applied the free end of the suture is drawn through the needle until it is somewhat longer than the remaining loose portion; when the needle is passed it leaves the buried part of the last stitch double with a free single strand upon the entrance side of the suture, and a double strand carrying the needle on the side of the exit. The double strand is then tied to the single one, thus securing the whole suture, and all ends are then cut away. Another method begins as did the first. The needle is then inserted close to its point of first entrance and carried at an angle of forty-five degrees to the line of incision to the opposite side of the wound, where it is brought out as in the previous method. It is then carried directly across the wound and entered at a point opposite its exit, passed at an angle of forty-five degrees as before and again brought out. This is repeated until the wound is closed. When the end is reached the needle enters opposite the point of last exit and is brought out again close to it—the arrangement of the thread being as in the first method—and then the single end is tied to the double one. An analysis of it shows the same number of needle punctures as by the other example, the only difference being that here the exposed portion is at a right angle to the wound, while the buried part is at an angle of forty-five degrees, whereas by the former method the location of the buried portion is reversed. The first one is the better by reason of greater ease in keeping the landmarks, greater rapidity in application, and less injury to the tissues.

Buried Sutures.—The buried suture serves the purpose of the interrupted suture of approximation, and therefore displaces the latter, and is invaluable in bringing together with accuracy deep layers of muscles or aponeurosis. It also obliterates dead spaces in deep wounds, a requisite of perfect repair by aseptic methods. Its manner of insertion is usually

similar to that already described, although there is not the same necessity for exact application as when used upon the skin. After tying, the ends are cut as short as is consistent with the maintenance of the knots. The buried suture may take either the continuous or interrupted form. Being of great merit, it is used in all parts of the body and has a most varied applicability. The success of many of the modern operations is dependent

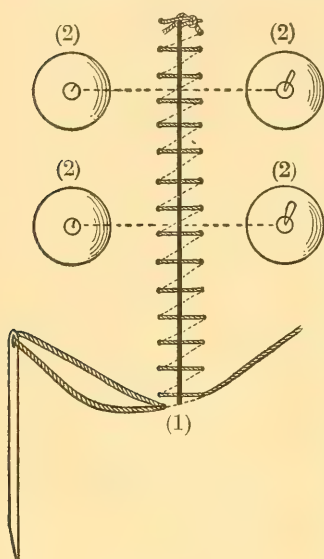


Fig. 1095.
1. Continuous Suture.
2-2. Deep Button Sutures.

on this form of suture, while for rapidly uniting deep tissues either for the purpose of obliterating what would otherwise be dead spaces, or for uniting planes like the peritoneum, this form of sutures is indispensable.

Button Suture.—This is always a suture of relaxation and is now chiefly applied with silver wire. For the support of heavy flaps, as after some breast amputations, or for the fixation of wounds upon which much strain may be placed, silver wire is without a superior; in closing the abdominal cavity no method gives so sure a fixation and immobilization of the wound-area as the use of the silver wire button suture of relaxation. The strain of vomiting, of defecation, of the rise and fall of the abdominal wall in res-

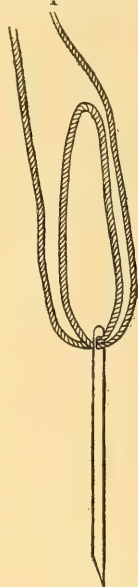


Fig. 1096.
Pilot Thread.

piration are all borne by these sutures, which are in the nature of subcutaneous splints. There is no tendency to strangulation of the included area as in the use of deep sutures of silk, nor is there an equal liability to stitch abscess. The strangulation resulting from tightly tied sutures, with the consequent aberration of circulation, lessens the resistance of the included area and so favors the formation of pus. With the button suture even where the tension is equivalent to, or even greater than in the interrupted silk suture, there is no strangulation, but rather a condition of firm suspension. This suture is applied by means of a pilot thread which serves as a leader for the wire. The needle selected is threaded with one end of a piece of silk about twenty inches long. The other end of the thread is then passed through the eye of the needle in a direction opposite to the first end, and the two free ends are drawn through until they are an inch longer than the intervening loop. This does away with the necessity of a knot at the eye of the needle as is sometimes recommended. By reason of the loop which carries the wire being shorter than the free ends the needle will not become unthreaded. As the four strands lie together in following the needle all

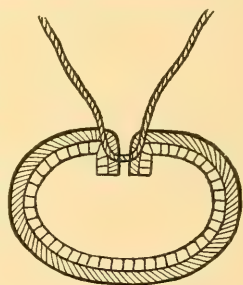


Fig. 1097.
Showing Muscular and Mucous Coats of Intestine. Lembert Suture Indicating Line of Passage of Suture through Serous and Muscular Coats only.

are subject to the same pressure, and as the loop is the shortest it is the first to be freed from the tissues. The two longer free ends are still within and some resistance is offered to their exit, which is sufficient to prevent them from leaving the eye of the needle.

Pin Suture.—The pin or harelip suture is little used at present and only recommended where there is great tension on the flaps due to loss of tissue. Better results can now be obtained in these conditions by other simpler and more controllable methods. The same may be said of many other forms of suture which are now practically obsolete, such as the bead suture, quill suture, coil suture, etc.

Visceral Sutures.—The exigencies of modern operations and the wonderful advances made in visceral surgery have developed a class of sutures applicable only to the hollow viscera. These are always of silk or sheep-gut, are very fine, and applied by means of a round needle as small as will carry the suture, an ordinary sewing needle being usually selected. This is supposed to force its way through the fibres, separating but not dividing them, thus allowing them to contract about the suture,

which also more completely fills the round hole made by the needle than if it were of some other form. All these sutures are designed with special reference to bringing together and holding in close connection peritoneal surfaces. The peritoneum unites so rapidly when properly apposed, and it is so necessary to have the bowel sealed as quickly as possible that any method adopted has for its first object the immediate closing of

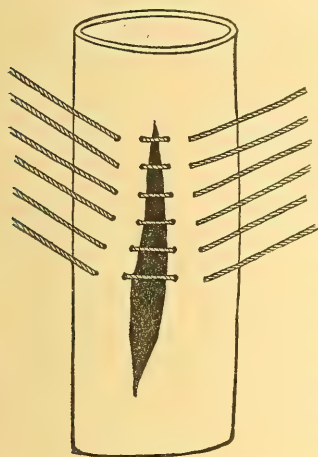


Fig. 1098.
Lembert Suture (Interrupted)
Showing Relation of Suture to
Opening in Intestine.

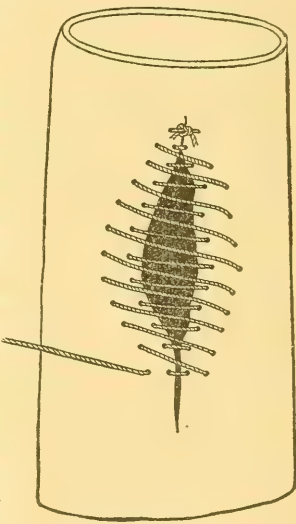


Fig. 1099.
Lembert Suture (Continuous)
Showing Relation of Su-
ture to Opening in In-
testine.

the opening in such a manner that no leakage of the bowel contents can take place before closure is assured, and that permanent healing may cause as little tendency to stricture as is possible.

LEMBERT SUTURE. This suture has received the most general acceptance as accomplishing these objects in the most simple way. The characteristics of it are that it apposes peritoneal surfaces, does not puncture the intestinal wall as a whole, and is more rapidly applied than any other. Originally it was an interrupted suture, but the same principle has become so extensively used in the continuous form that it is now usually spoken of as the "continuous Lembert suture." It is applied by picking up the peritoneum about one-third of an inch from the wound margin, carrying it down to but not through the mucous coat and bringing it out again about one-eighth of an inch from the cut edge of the wound,

the needle being then carried across the wound and the process repeated in reverse order upon the opposite side.

If interrupted sutures are to be used these are passed and left to be tied after several or all are in position. If the continuous suture is applied the first stitch takes up the tissues a little beyond the angle of the wound and is tied firmly enough to closely hold the included parts but not to constrict or cut them. It is then carried out after the same manner as when applied to the skin, care always being taken that the needle does not penetrate the mucous coat, and that the edges are carefully incurved so that peritoneal surfaces are in apposition. The suture is drawn into place as applied and is better than an interrupted suture because it evenly regulates tension throughout and leaves no weak spot caused by one insecure point, as may easily be the case with a number of interrupted sutures. In intestinal work individual stitches should be

used closely, from six to eight to the inch, lest the gas distension following all manipulations of the bowel cause a leakage of contents.

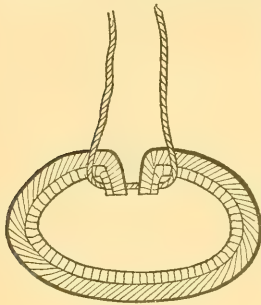


Fig. 1100.

Jobert Suture, Indicating Relation of Suture to the Different Coats of the Intestines.

JOBERT'S SUTURE. This differs from Lembert's only in that it pierces all the coats of the intestine. It is fastened tightly and is supposed to cut through into the bowel.

It is not in such favor as the Lembert, because each stitch causes four needle punctures of all the coats, and these are

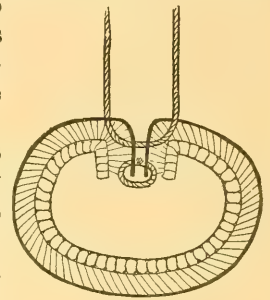


Fig. 1101.

Czerney Suture, Indicating Relation of the Two Portions of the Suture to Each Other and to the Coats of the Intestines.

considered weak points, liable to result in leakage. The Jobert suture is little used.

CZERNEY'S SUTURE. The only modification of Lembert's suture which has received a wide-spread acceptance is Czerney's. He advocated first uniting the cut peritoneal edges with a separate suture, preferably continuous than interrupted, although his original recommendation was an interrupted suture. After this is applied a continuous Lembert suture is inserted exactly as if the first were not there. This doubly seals the viscus and has given excellent results.

Many other ingenious methods have been devised, all having the same objects—the apposition of peritoneal surfaces and the prevention of leakage. They accomplish these objects but at the expense of too much time and mechanism and are therefore rarely used. Among these may be mentioned Emmert's, Gely's, Gussenbauer's, Bouisson's and several others.

Halstead's quill suture is excellent in some places, but is not much used in hollow viscera, although sometimes recommended. In some special operations, as in the radical cure of hernia, it gives most excellent results.

The needs of any special operation may develop some special form of suture, but it is hardly necessary to enumerate all. If the surgeon understands the principles of the different sutures, however, he quickly grasps their relevancy to any new form of detail and readily seizes the practical application, which after all is the desideratum.

CHAPTER V.

LIGATURES AND LIGATURE MATERIALS.

Sterilization.—The materials for ligatures are practically the same as those for sutures. Of the many things tried silk and animal materials are the ones at present solely in favor, and some form of absorbable ligature is now almost universally used even on the larger vessels. In the course of an ordinary operation absorbable ligatures may be freely employed, the absolutely essential requisite being that they shall be sterile.

Whatever form of suture or ligature is used the proper preparation of it by some means of sterilization is imperative, and it is one of the troublesome questions of the day how to sterilize and keep sterile suture and ligature materials. Sheep-gut has been discarded by many operators because of the difficulty in first rendering and then keeping it sterile. On the other hand, many who defend it declare that silk is little better and that while it is easy to render it sterile it is exceedingly prone to become infected when left in the tissues. Many ways of accomplishing sterilization have been advocated but not all will be here discussed.

HEAT. Some form of heat of sufficiently high degree, kept at that temperature long enough to kill, not only all bacteria but also all spores, has become recognized as a better way than reliance upon chemical sterilization. The latter has a definite place in keeping aseptic materials which have already been sterilized by heat. Suture and ligature materials can be heated according to their individual peculiarities until sterile. Silk should be boiled for fifteen minutes in one per cent. solution of carbonate of soda and then kept with the instruments and dressings also prepared for any special operation. As silk is so easily infected, yet so quickly sterilized, and as instruments and whatever else is necessary must be prepared for each operation, it seems better to prepare the silk for each operation or set of operations than to try to preserve it in antiseptic solutions. If so kept it should be in a 1 to 500 solution of bichloride of mercury in absolute alcohol.

Silk-worm suture may be prepared like silk and kept in a similar manner. Instead of boiling it it may be steamed in one of the many steam sterilizers now in use, the results being the same as if boiled.

Animal materials may be quickly prepared by placing in absolute alcohol in a vial or vessel capable of being tightly stoppered, and then boiling the latter for half an hour. Alcohol at its own boiling point does not sterilize, yet treated as above recommended it is raised to at least 212 degrees Fahrenheit, which gives a practical sterilization.

Another method which in the author's hands has invariably given satisfaction is to first place the material in oil of juniper, leaving it three days; this is supposed to extract and displace the animal fats and oils—in fact a jar of oil is always at hand in which it is kept indefinitely, and from this it is transferred to the next step of the preparation. This con-

sists of a bath in absolute alcohol at least three successive times, the last immersion being continued long enough to extract all of the oil.

Whichever method is used it is then put into a 1 to 500 solution of bi-chloride of mercury in absolute alcohol, or, better still, a solution of similar strength to which ten per cent. of pure glycerine has been added. The alcohol alone makes the material hard, stiff and difficult to manipulate, whereas the glycerine keeps it just soft enough for immediate use and easy management. Immediately before using them all such materials should be transferred from the strong solution of mercury to sterilized water or salt solution, to reduce the strength of the mercury which may be in or on them.

Silver wire may be sterilized by dry heat, by boiling, or by steam heat. It is best cut into lengths of from twelve to sixteen inches and kept in tubes closed at one end and stopped at the other with cotton. This can be put into the dry sterilizer and kept undisturbed until the time of use. Different sizes may be kept in the same tube, as selection is easy. Silk and gut should be kept in jars previously sterilized, each size having a separate jar plainly marked with a number of the contained material and the date of sterilization. Silk-worm suture which is in two inconstant sizes should be kept in separate jars, also marked with a date as above.

CHAPTER VI.

DRAINAGE—SPONGES—GAUZE DRESSING.

Drainage.—The subject of drainage has been provocative of much discussion in the past, and widely-differing views have been entertained. There is little question that drainage has been overdone and used frequently without the slightest indication for it. Where formerly it was almost always employed in the abdominal cavity, it is now almost always avoided. The mere fact of a rather free oozing from adhesions is no indication for drainage. This oozing, no matter how profuse, can be controlled, and when controlled drainage is not necessary. The demand here is to stop the hemorrhage, not to provide an exit for it. In extensive non-septic wounds no matter of what character drainage is seldom necessary. In an ordinary aseptic wound, it is true, the serum accumulating from the cut surfaces is an ideal place for the development of bacteria, but a properly closed wound no longer provides for such escape of serum and does not allow it to accumulate. When every wound was flushed with hot carbolic acid, 1 to 40, or hot bichloride of mercury, 1 to 2,500, the result was a profuse secretion of serum, far beyond what would otherwise be thrown out, with the resulting necessity of a provision for its escape. Now that such solutions are not used in wounds unless they are already septic, the same necessity for drainage no longer exists. In wounds where it is known that the after-course will be one of sepsis, or where we reason that the probabilities would lead us to expect sepsis, drainage may be frequently necessary, but in operations aseptic from beginning to end, no matter how extensive, drainage has no place. Drainage should be used only when necessary, as it is liable to convert an aseptic condition into a septic one.

FORMS. Drainage may be classed as natural and artificial. The former is the better way when possible, as the desired end is gained by posture and the arrangement of the parts in closing the wound. Frequently a stitch omitted at the most dependent part of the wound allows escape of all serous oozing, and yet does not favor any septic contamination.

ARTIFICIAL DRAINAGE. Drainage by artificial means is either tubular or capillary. Various tubes have been used, rubber and glass being the favorites to-day.

Rubber Tubes. Ordinary rubber tubing is inserted either single or double. If a single tube is used it should be perforated at intervals of about one inch with oblong holes, the long diameter of which conforms to the length of the tube; it should then be carried to the bottom of the cavity to be drained and either brought out at the most convenient part of the wound, or find its exit through an opening made especially for it. If a double tube is used it is arranged by doubling the tube at its centre and cutting at about an angle of forty-five degrees from the middle of the end of the tube so bent, outward; a fenestra is thus formed and the intact portion of the tube remaining is then used as a hinge. One arm is filled

with holes and the other left whole, and the double tube is then carried to the bottom of the cavity at the selected point.

The tubes are cut off so as to project slightly beyond the surface, and are secured to the skin by a silk-worm stitch or a safety pin passed transversely through the tube. If pus is present and a stitch is inserted the course of it is liable to become infected and the stitch be cut out if left for several days. On the other hand, a pin may disappear within the cavity—as once happened in a case of empyema where a double tube at least ten inches long and a large safety pin were both taken into the chest cavity, only to be fortunately expelled the next day. Tubes which are to be left a long time must be carefully watched. In putting double tubes into the abdominal cavity care must also be taken that a loop of intestine does not become entangled between the two tubes, thereby becoming constricted or even gangrenous. This has occurred and the tubes gave much trouble in removal. If tubes are left for some time they must not be allowed to lie in one position undisturbed, lest granulation or other tissue so encroach upon the openings in the tubes that they are withdrawn with difficulty. With rubber tubes, if they cannot be withdrawn at once, an excellent way is to shorten them from day to day by cutting off a part of the protruding portion, finally doing away with them.

Glass Tubes. Glass tubes are much used about the abdomen, but must be employed with care lest their weight and the pressure of the external dressings cause the lower end to perforate the intestine.

Metal Tubes. Metal tubes have been employed and still have a limited use in such cases as empyema, where long continued or permanent drainage is desired.

Absorbable Tubes. Absorbable tubes have also been much used for cases where it was desirable to maintain drainage for a few days only. Absorbable tubes went with the use of antiseptics in wounds and were a rather necessary accompaniment. They were used for the purpose of carrying off the serum secreted, without disturbing the dressings, and as the former could be accomplished in about forty-eight hours the tube was no longer necessary after that time, hence the desirability of a tube to do all this and then disappear. Such tubes were found in decalcified bone. The long bones of chickens were treated in dilute hydrochloric acid until the earthy parts were removed, when they were further treated like animal sutures to render them antiseptic. These were then perforated and kept in carbolized oil until ready for use. They were placed as any other tube would be, secured to the skin by a gut-suture, and then the dressings made as if there were no tube within, except that they were bulky enough to take up an enormous discharge. The serous discharge was aggravated by the presence of the tube, which broke down in the liquid with which it was bathed and flowed away to the dressings without. The tissues had very little action in absorbing it. These tubes are not often used now.

CAPILLARY DRAINAGE. Capillary drainage is sometimes a most satisfactory method of draining a small cavity, and depends for its action on the capillary attraction exerted by bundles of parallel strands of whatever substance is used. Gut has been much used, as it could be left in place without removing. By the time its function ceases it becomes liquefied or absorbed and so there is no necessity for disturbing the dressings. Horse hair, spun glass, silk and many other substances have been

employed, but the method is not in common use to-day since drainage is so much less required.

If the surfaces of the wound are irritated as little as possible, and if the blood is removed as rapidly as secreted by careful sponging, all larger vessels being secured in the meantime, it has been found that most extensive wounds can be closed without drainage, care being taken to have a good apposition of cut surfaces and pressure sufficiently firm being applied by means of dressings to immobilize and hold the parts in position. If properly closed and dressed such wounds unite by first intention as readily as do the most insignificant, nature seeming to recognize little difference in the size of wounds provided they are under identically similar conditions. The materials for drainage may be sterilized by boiling for five minutes in a one per cent. soda solution, and then kept in a one to twenty solution of carbolic acid. The absorbable tubes may be treated exactly like the gut, although boiling in the alcohol will give more satisfactory results. They should be kept in the same manner as gut.

Sponges.—Sponges have passed through the closest scrutiny with all other materials and have been found wanting. As a result substitutes have been introduced and at present are much in favor. It seems advisable to call these substances, which have usurped the function of natural sponges, artificial sponges, although they are not sponges at all. Natural sponges are excellent in some respects, but the objections to them are so pronounced that they are rapidly giving way to other material. They must be most carefully prepared, and this has been found to be a long and tedious process, so much so that this alone has condemned their use.

PREPARATION. When they are used small soft sponges are selected, placed in a loose gauze bag and beaten until thoroughly freed from sand; then from each is carefully removed every particle of shell or calcareous matter, after which they are repeatedly washed in water frequently changed. It does not suffice to put them under a tap of running water; they must be squeezed and manipulated in order to force the water into and through every canal. Next they are put for half an hour into a saturated solution of permanganate of potassium, from which they are squeezed out as dry as possible and put into a solution of hydrochloric acid of the strength of three fluid ounces of concentrated acid to a gallon of sterilized water, to which one ounce of hyposulphite of soda has been added. As soon as bleached in this they are transferred to sterilized water and thoroughly washed, the water being changed until the acid is thoroughly removed. Next they are soaked for several hours in a 1 to 500 bichloride solution, and finally kept in a three to five per cent. solution of carbolic acid. This last solution should be changed every few days at stated intervals, and the sponges should be removed from it for use immediately before the operation. If kept long in either a carbolic acid or mercury solution they become softened and discolored and so friable that their use may be unsafe. If sponges are used they can be bought sufficiently good for the purpose at a cost of about a cent each, and these should be selected. Under no circumstances should they be used a second time, no matter how careful a preparation may be given them.

Artificial Sponges.—The difficulties in such preparation and the time required led to trials of other substances, and now artificial

sponges of gauze are in quite general use. They are sponges in everything except the material of which they are made. They are made in several sizes, the most common being formed by folding several thicknesses of gauze into a square four inches on a side, turning in the raw edges and sewing them together with a quickly applied running stitch. Two other sizes are convenient, one four inches wide and eight inches long, and another eight inches square. (Fig. 1102). Another form is made by loosely gathering together the corners of several squares of gauze and firmly tying them, cutting off the free part above the thread. No matter in what form they are made they answer all the purposes of a natural sponge, except in some special operations—about the nose and throat and in eye operations, for instance, nothing takes the place of a soft natural sponge. Their advantages are the ease with which they are made and sterilized, and their cheapness. Those used are thrown away after each operation and never do duty a second time. They must be sterilized before each operation, and this is best done by steaming in an Arnold sterilizer or one equally efficacious.

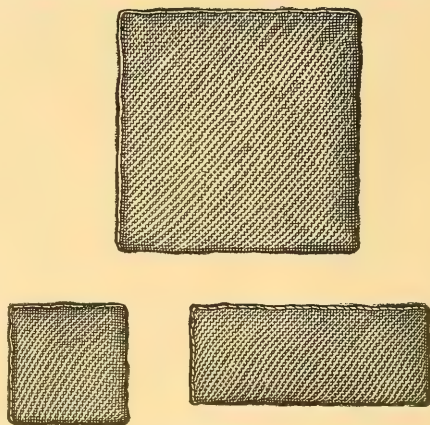


Fig. 1102.
Artificial Sponges.

LOOSE GAUZE. Gauze cut in strips three inches wide, the width of the weave and loosely gathered in the hand, serves an excellent purpose for sponging. The advantages of this are that each piece is used but once and then thrown away, and the possibilities of infection from extraneous sources are reduced to a minimum. This bleached gauze is in various ways a valuable addition to our surgical accessories. It is cheap, costing in quantity less than three cents per yard. The manufacturers cut it into three-inch strips when desired, which much facilitates the subsequent treatment of it. It is soft, absorbs as readily as a natural sponge, is very easily sterilized, and is so inexpensive that it can be freely used and thrown away. When made into sponges they are sterilized by loosely wrapping those selected for an operation in a single thickness of this same gauze, tying the two opposite corners together. This is then steamed for half an hour in the steam sterilizer, when the whole is lifted out and wrapped in towels previously sterilized. If convenient, a few moments' exposure in the dry sterilizer will drive out any retained moisture. The loose gauze, in strips three inches wide, is folded back and forth until about five inches long, so arranged in piles that an end always lies on top and exposed, and by picking this up one strip is secured, yet leaves the next one ready at hand. Any escape of bits of the cotton thread forming the gauze causes no subsequent trouble, since it is always in small particles and is thoroughly aseptic. It causes less trouble than would the finest silk ligature or suture left in position. This arranged in convenient piles is inclosed in a piece of gauze as were the sponges, and sterilized in an exactly similar manner.

Gauze Dressing.—Another convenient use is to fold the gauze into whatever size is most desirable, of from six to eight thicknesses, and thus make of it a body bandage or a bandage for any retaining purpose. It fits the parts accurately, moulds itself to the inequalities of the dressings, and can be easily wrapped in towels and sterilized with the other dressings. These outside bandages may be washed and used again after sterilizing anew. Large squares of this gauze are most convenient for inclosing towels, absorbent cotton, and indeed all implements and dressings which are to be exposed to either dry or steam sterilization. As a dressing applied next to the wound nothing better than this same gauze has been devised, whether after an aseptic operation or where pus or some copious discharge is expected. Placed next to the wound, covered in by absorbent cotton in layers, the whole confined by a snug-fitting but not tight bandage, the wound may be left for eight days before its first inspection and then found in perfect condition so far as the dressing influences the result. If there has been a discharge the gauze takes it up as thoroughly as any dressing yet devised.

Iodoform-gauze is frequently useful as a packing for tuberculous or septic conditions, or for the checking of hemorrhage not readily accessible. It should be sterilized before use.

Permanganate gauze is excellent for absorbing and deodorizing the offensive discharges of malignant conditions.

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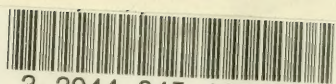
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